TECHNICAL REPORT
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ANTHROPOMETRIC SURVEY OF THE ARMED FORCES OF THE REPUBLIC OF KOREA

by

Gary L. Hart

George E. Rowland

Robert Malina

Rowland and Company, Inc.

Haddonfield, New Jersey

Contract No. DA19-129-AMC-480(N)

July 1967

UNITED STATES ARMY
NATICK LABORATORIES
Natick, Massachusetts 01760

Pioneering Research Laboratory
Technical Report EPT-7

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FOREWORD

Anthropometric data constitute a basic requisite for defining the elements of body size in the human engineering of man-equipment systems. Effective human engineering requires the use of data on the specific population for which the equipment is intended. Since no adequate data existed on the Republic of Korea Armed Forces, an anthropometric survey was conducted to collect data on the body dimensions of a large sample of this military population. Analysis of these data has made it possible to define the range and variation in body size to be expected in the military personnel of the Republic of Korea.

The results of this survey should be utilized in all areas of research and development where detailed knowledge of Korean body sizes and proportions are necessary. Anthropometric data on Korean military personnel are of primary application in the engineering design of military equipment for the Republic of Korea Armed Forces. The further application of this information to problems of design, sizing and fit of military clothing and personal equipment will result in increased efficiency, performance and comfort. Data on the range and variation of body size in the user population thus may be employed in the improvement of size systems and tariffing in order to achieve increased logistic efficiency and economy of supply.

This report represents the final report submitted by the contractor, Rowland and Company, Inc. under Contract No. DA19-129-AMC-480(N). The work reported herein was requested and sponsored by the Army Research Office, Office of the Chief of Research and Development, Department of the Army, and was monitored by the Anthropology Laboratory, U.S. Army Natick Laboratories. Collection of data in the field was accomplished 28 October 1966 as R&C Report No. 66-30-9.

GABRIEL R. MANDELS
Acting Director
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Commanding

TABLE OF CONTENTS

LIST OF TABLES

LIST OF TABLES (Continued)

LIST OF FIGURES

READER'S GUIDE

This report has been structured to facilitate the acquisition of specific types of information by readers with differing interests. It is envisioned that there will be at least four principal classes of readers; (1) those interested in the specific anthropometric findings regarding Korean body size; (2) those interested in comparative body size data between ROK and USA troops; (3) those interested in the methodological aspects of the study; and (4) those interested in the equipment evaluation data.

It is anticipated that the largest class of readers will be interested in the hard core data on body dimensions. They will want information which will assist them in designing and evaluating equipment to be used by the military populations of Korea. Consequently, the tables portraying anthropometric results, both Korean and ROK-USA comparative data, are included at the very beginning of this report, in Section I. The reader who is interested in the methodological aspects of the study is invited to read the entire report with emphasis on Section II-B. For the reader who is interested in the methodological aspects of the equipment evaluation portion of the study, the Appendix has been provided.

ABSTRACT

Anthropometric and equipment evaluation surveys of the military personnel of the Republic of Korea were conducted between May and November of 1965. Body measurements and equipment evaluation data were obtained on a series of 3,747 men (3,249 Army, 190 Air Force, 141 Navy, and 167 Marine). Fifty-nine body measurement and twenty equipment evaluation measures were made on each individual. Procedures and supporting equipment were developed during the course of the project which permitted the collection of more data with greater accuracy in less time and with statistical interpretability than in any other anthropometric survey of record.

Of the 59 body measurements taken from Korean soldiers, 39 were directly comparable with data which had been previously collected from U.S. troops. The differences between means of the two samples were statistically significant for 30 of the measures. The means of data from U.S. troops exceeded those of Korean soldiers on 33 of the measures, indicating larger physical size in almost all dimensions.

Korean troops expressed themselves on the question: "Insofar as 'fit' is concerned, the (equipment) supplied by the U.S. Army is ...." on a seven-point continuum ranging from "excellent" to "very poor." Respondents filled out a questionnaire containing general statements described above as well as more specific items relating to grasping, reaching, and positioning the equipment as far as comfort and effectiveness were concerned. Subjects rated the smaller, lighter equipment favorably with respect to ease of handling, and reported considerable difficulty using larger weapons and equipment.

SECTION I

SUMMARY OF RESULTS

A. ANTHROPOMETRIC RESULTS

The section which follows contains summary statistics of the anthropometric results of the study. Reference diagrams are included as an aid to quick analysis of the data contained in the tables. The percentiles and statistical values displayed in tables 1-1 through 1-10 are based upon the total sample of 3,747 men. The values are expressed in centimeters, with the exception of weight (No. 55) which is shown in kilograms.

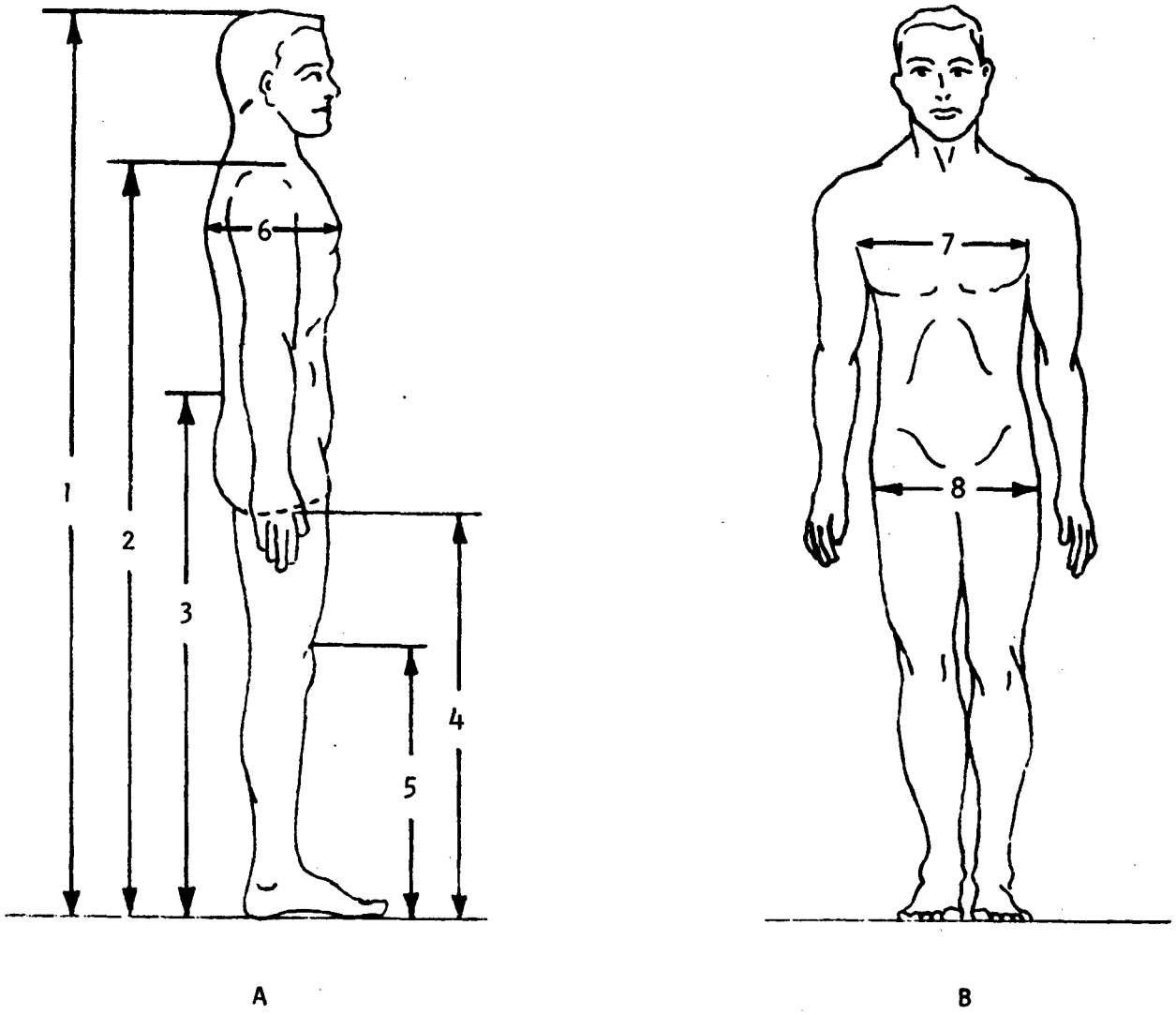

Figure 1. Standing Measurements

TABLE 1-1. PERCENTILES OF STANDING MEASUREMENTS
(values in centimeters)

	Standing Measurements	Percentiles										
		1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th
1.	Stature	153.7	155.1	156.7	158.8	161.8	165.3	168.4	171.6	173.0	175.2	176.4
2.	Shoulder height	122.4	124.1	126.3	128.3	131.2	134.3	137.3	140.0	141.5	143.1	144.4
3.	Waist height	86.9	88.2	89.9	91.5	94.2	97.2	99.6	101.9	103.4	104.9	106.3
4.	Crotch height	65.7	67.3	68.6	70.2	72.5	75.1	77.5	79.6	80.9	83.6	87.4
5.	Kneecap height	40.6	41.4	42.6	43.4	44.9	46.7	48.5	50.0	51.0	52.1	52.8
6.	Chest depth	19.0	19.4	19.8	20.1	20.9	21.8	22.5	23.3	23.9	24.7	25.0
7.	Chest breadth	23.0	25.0	26.2	26.9	27.9	29.0	30.0	31.2	32.1	33.3	34.0
8.	Hip breadth	26.0	26.9	28.0	28.6	29.5	30.5	31.5	32.3	32.7	33.4	34.0

N = 3,747

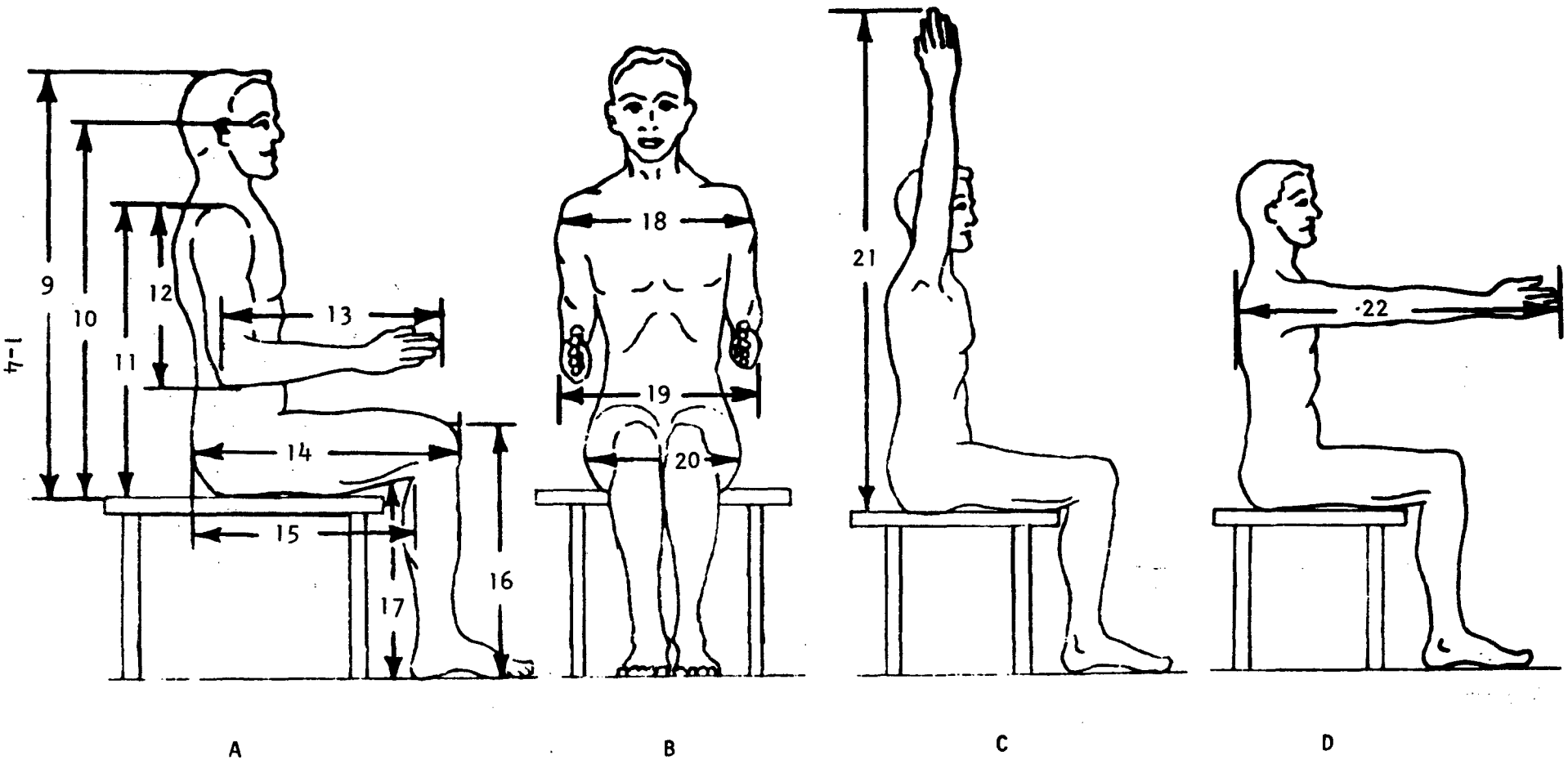

Figure 2. Sitting Measurements

TABLE 1-2. PERCENTILES OF SITTING MEASUREMENTS
(values in centimeters)

		Percentiles										
	Sitting Measurements	1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th
9.	Sitting height	81.0	82.2	84.0	85.4	87.3	89.1	90.9	92.4	93.3	94.0	94.4
10.	Eye height	69.9	71.1	72.8	74.3	76.3	78.2	80.2	81.8	82.7	83.9	85.9
11.	Shoulder height	50.1	50.9	53.5	54.5	56.5	58.3	60.0	61.9	63.1	64.9	67.3
12.	Shoulder-elbow length	28.4	29.5	30.5	31.4	32.4	33.6	34.7	35.9	36.4	37.2	37.8
13.	Forearm-hand length	34.8	39.9	41.1	41.9	43.0	44.1	45.3	46.2	46.7	47.5	47.9
14.	Buttock-knee length	44.5	47.4	49.7	50.7	52.2	54.0	55.4	56.9	57.9	58.9	59.7
15.	Buttock-popliteal l'th	36.4	37.8	39.0	40.0	41.3	43.0	44.5	46.1	47.5	48.7	49.6
16.	Knee height	40.6	41.8	44.4	45.5	47.0	48.5	50.2	51.9	53.4	56.9	57.7
17.	Popliteal height	30.8	33.3	35.5	36.6	37.7	39.0	40.4	41.8	42.7	44.7	47.8
18.	Shoulder breadth	38.1	38.4	39.3	40.1	41.2	42.4	43.8	44.9	45.6	46.5	47.3
19.	Elbow to elbow b'th	31.9	33.9	36.0	37.0	38.6	40.3	42.0	43.4	44.5	46.0	47.2
20.	Hip breadth	28.1	28.9	29.5	30.1	31.0	32.0	33.2	34.3	35.0	36.0	36.8
21.	Arm reach, upward	120.9	122.3	124.4	126.2	128.8	131.9	134.9	137.4	139.2	140.8	142.2
22.	Arm reach, forward	70.6	71.7	73.3	75.2	78.1	80.7	83.4	85.5	87.0	88.9	90.1

N = 3,747

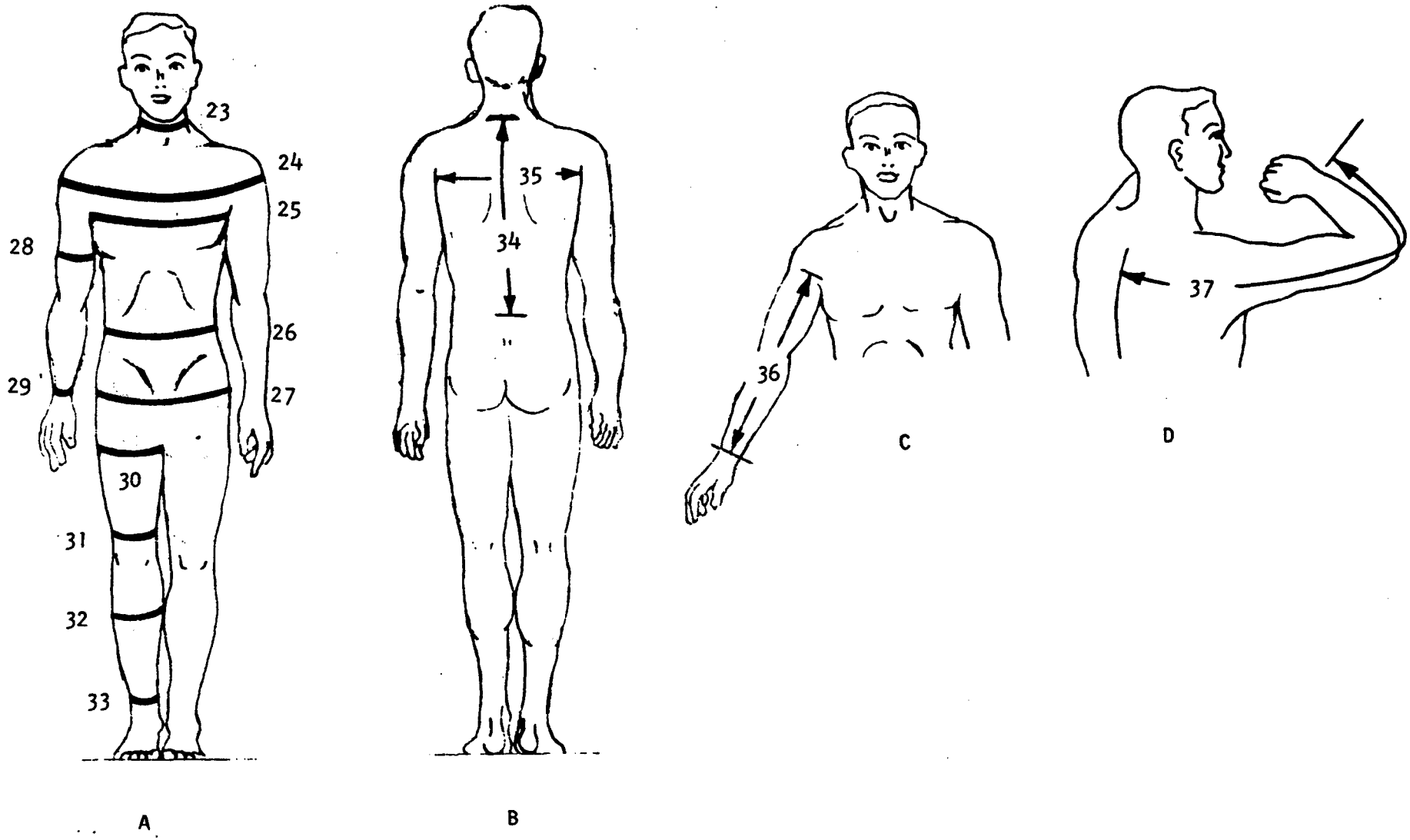

Figure 3. Body Circumferences and Surface Measurements

TABLE I-3. PERCENTILES OF CIRCUMFERENCE AND SURFACE MEASUREMENTS
(values in centimeters)

		Percentiles										
		1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th
	Body Circumferences											
23.	Neck	31.0	31.5	32.0	32.5	33.4	34.3	35.2	36.2	37.0	37.8	38.4
24.	Shoulder	95.6	97.2	99.2	100.6	102.7	105.2	108.2	111.0	113.0	116.1	119.2
25.	Chest	79.7	80.7	82.0	83.5	85.7	88.4	91.0	93.7	95.3	97.8	99.0
26.	Waist	65.9	66.9	68.5	69.5	71.6	74.0	76.5	79.2	81.0	83.1	86.5
27.	Hip	78.9	80.4	82.0	83.1	85.0	87.5	89.8	91.7	93.1	94.2	95.5
28.	Upper Arm	21.0	22.0	22.9	23.5	24.4	25.4	26.5	27.7	28.4	29.4	29.9
29.	Wrist	14.1	14.7	15.0	15.4	15.9	16.4	17.0	17.5	17.9	18.4	18.6
30.	Crotch thigh	41.9	43.1	44.7	45.7	47.2	49.0	50.9	52.6	53.5	55.0	55.8
31.	Lower thigh	32.0	32.8	33.7	34.6	36.1	38.0	40.0	41.9	43.3	45.0	46.4
32.	Calf	27.7	30.5	31.5	32.2	33.4	34.5	35.9	37.1	38.1	38.9	39.8
33.	Ankle	19.0	19.3	19.8	20.0	20.5	21.2	22.0	22.9	23.9	31.2	32.0
	Surface Measurements											
34.	Back waist length	40.4	41.0	42.3	43.2	44.5	46.0	47.7	49.4	50.3	51.5	52.5
35.	Interscye	31.4	32.4	33.5	34.4	35.9	37.5	39.5	41.5	43.4	46.5	47.9
36.	Sleeve inseam	39.9	40.4	41.4	42.1	43.5	45.1	46.5	48.0	48.8	50.0	50.8
37.	Sleeve length	71.0	71.9	73.5	74.9	77.0	79.5	81.5	83.6	84.9	86.9	87.5

N = 3,747

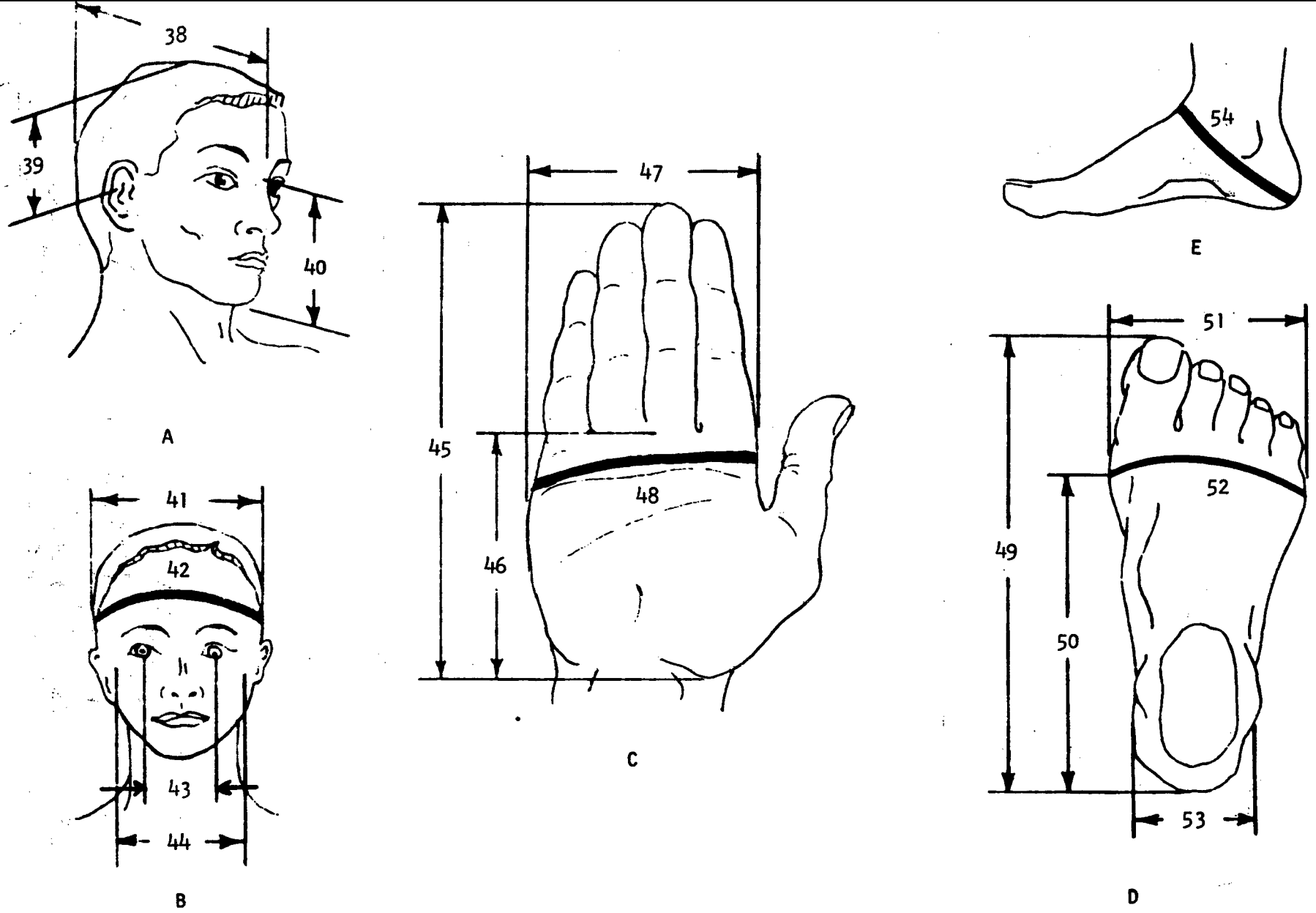

Figure 4. Head, Hand, and Foot Measurements

TABLE 1-4. PERCENTILES OF HEAD, HAND, AND FOOT MEASUREMENTS
(values in centimeters)

		Percentiles										
		1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th
	Head Measurements											
38.	Head length	16.1	16.4	16.7	17.0	17.4	17.9	18.4	18.8	19.1	19.3	19.5
39.	Head height	10.4	10.8	11.1	11.4	12.0	12.5	13.0	13.5	13.8	14.2	14.4
40.	Face length	10.2	10.4	10.6	10.9	11.3	11.7	12.1	12.4	12.6	12.8	12.9
41.	Head breadth	13.3	13.7	14.1	14.5	14.9	15.4	15.8	16.2	16.4	16.6	16.7
42.	Head circumference	51.4	51.6	52.2	52.7	53.5	54.4	55.3	56.0	56.7	57.2	57.5
43.	Interpupillary Distance	5.4	5.5	5.5	5.6	5.8	6.1	6.3	6.5	6.7	6.8	7.0
44.	Face breadth	12.3	12.6	13.0	13.4	13.9	14.4	14.7	15.1	15.3	15.5	15.6
	Hand Measurements											
45.	Hand length	16.3	16.5	16.9	17.1	17.5	18.1	18.6	19.0	19.3	19.5	19.8
46.	Palm length	8.8	9.0	9.4	9.7	10.0	10.3	10.6	10.9	11.1	11.4	11.7
47.	Hand breadth	7.5	7.6	7.8	8.0	8.2	8.5	8.7	9.0	9.1	9.4	9.7
48.	Hand circumference	18.4	18.8	19.2	19.5	20.0	20.6	21.3	21.9	22.4	24.2	26.5
	Foot Measurements											
49.	Foot length	20.3	20.4	22.1	23.2	23.9	24.5	25.2	25.8	26.3	26.7	27.5
50.	Instep length	15.5	15.7	15.9	16.0	17.7	18.4	18.9	19.5	19.8	20.0	20.3
51.	Foot breadth	8.6	8.8	8.9	9.0	9.3	9.5	9.8	10.1	10.3	10.5	10.6
52.	Ball foot circum.	21.9	22.3	22.7	23.2	23.9	24.6	25.4	26.0	26.5	27.0	27.4
53.	Heel breadth	15.5	5.6	5.8	6.0	6.3	6.5	6.7	6.9	7.1	7.2	7.4
54.	Heel-ankle circum.	22.1	24.1	29.7	30.4	31.1	32.0	32.9	33.8	34.3	35.0	35.5

N = 3,747

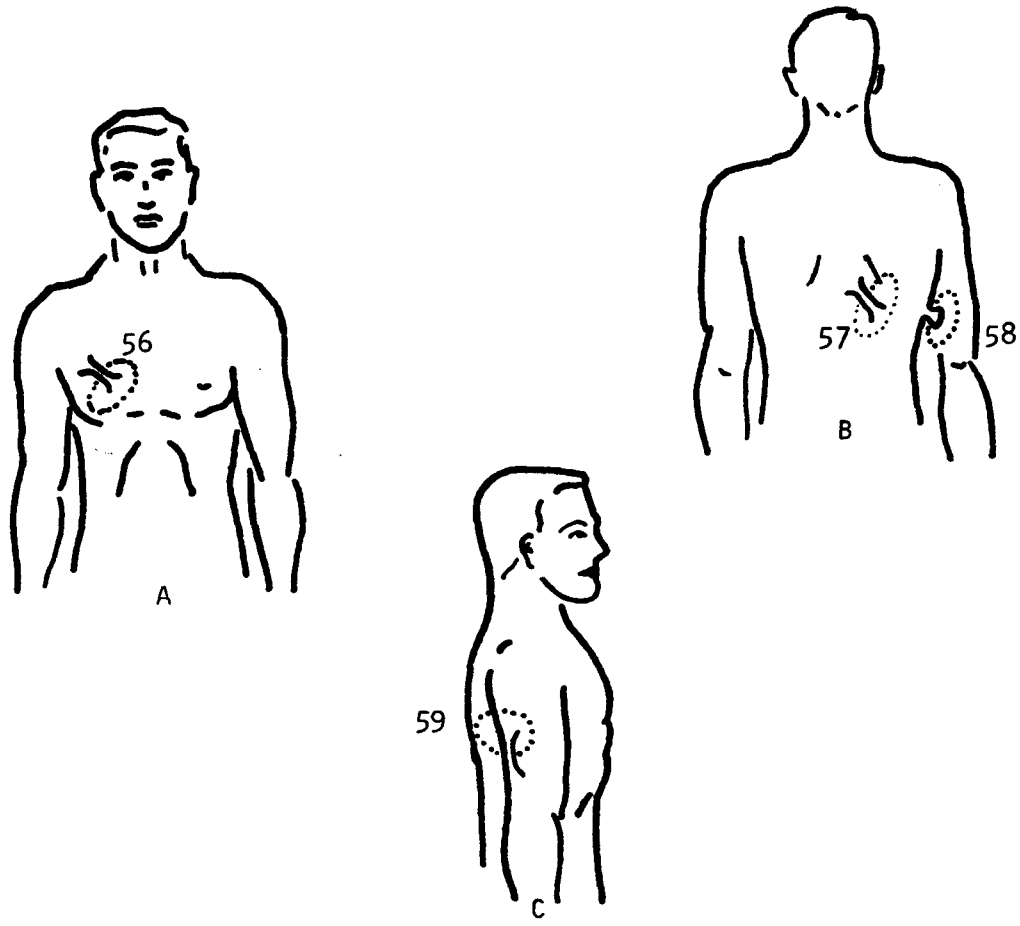

Figure 5. Skin-fold Measurements

TABLE 1-5. PERCENTILES OF WEIGHT, AND SKIN-FOLD THICKNESS
(values in centimeters)

		Percentiles										
		1st	2nd	5th	10th	25th	50th	75th	90th	95th	98th	99th
	Weight											
55.	Weight in kilograms	48.3	49.0	51.0	53.0	55.1	58.1	61.1	65.0	67.1	69.1	70.1
	Skin-fold thickness											
56.	Juxta-nipple	.12	.14	.20	.21	.26	.33	.43	.55	.63	.76	.87
57.	Sub-scapular	.31	.35	.42	.49	.59	.70	.85	.95	1.02	1.09	1.13
58.	Mid-axillary	.14	.17	.21	.24	.31	.38	.47	.57	.64	.73	.80
59.	Triceps	.21	.22	.25	.29	.36	.46	.59	.73	.82	.97	1.07

N = 3,747

TABLE 1-6. STATISTICAL VALUES OF STANDING MEASUREMENTS
(values in centimeters)

Standing Measurements	Mean	Standard Deviation	Coefficient of Variation
1. Stature	165.2	4.9	3.0
2. Shoulder height	134.1	4.7	3.5
3. Waist height	98.8	4.2	4.3
4. Crotch height	75.0	3.8	5.2
5. Kneecap height	46.7	2.6	5.7
6. Chest depth	21.8	1.2	6.0
7. Chest breadth	29.0	1.9	6.6
8. Hip breadth	30.5	1.6	5.5

N = 3,747

TABLE 1-7. STATISTICAL VALUES OF SITTING MEASUREMENTS
(values in centimeters)

	Sitting Measurements	Mean	Standard Deviation	Coefficient of Variation
9.	Sitting height	89.0	2.7	3.1
10.	Eye height	75.1	3.1	4.2
11.	Shoulder height	58.2	3.1	5.3
12.	Shoulder-elbow length	33.5	1.9	5.7
13.	Forearm-hand length	44.0	2.0	4.7
14.	Buttock-knee length	53.8	2.7	5.0
15.	Buttock-popliteal length	43.0	2.6	6.3
16.	Knee height	48.7	2.9	6.0
17.	Popliteal Height	39.1	2.4	6.5
18.	Shoulder breadth	42.5	1.9	4.5
19.	Elbow to elbow breadth	40.2	2.7	6.8
20.	Hip breadth	32.1	1.7	5.6
21.	Arm reach, upward	131.9	4.5	3.4
22.	Arm reach, forward	80.6	4.2	5.2

N = 3,747

TABLE 1-8. STATISTICAL VALUES OF CIRCUMFERENCE AND SURFACE MEASUREMENTS
(values in centimeters)

		Mean	Standard Deviation	Coefficient of Variation
	Body Circumferences			
23.	Neck	34.4	1.5	4.6
24.	Shoulder	105.6	4.4	4.2
25.	Chest	88.5	4.1	4.7
26.	Waist	74.3	4.0	5.4
27.	Hip	87.5	3.3	3.9
28.	Upper arm	25.5	1.8	7.4
29.	Wrist	16.4	.9	5.9
30.	Crotch thigh	49.1	2.8	5.8
31.	Lower thigh	38.2	2.9	7.8
32.	Calf	34.6	2.3	6.7
33.	Ankle	21.6	2.1	10.1
	Surface Measurements			
34.	Back waist length	46.2	2.4	5.3
35.	Interscye	37.9	3.0	8.1
36.	Sleeve inseam	45.1	2.3	5.1
37.	Sleeve length	79.4	3.4	4.4

N = 3,747

TABLE 1-9. STATISTICAL VALUES OF HEAD AND HAND MEASUREMENTS
(values in centimeters)

		Mean	Standard Deviation	Coefficient of Variation
	Head Measurements			
38.	Head length	17.9	.7	4.1
39.	Head height	12.5	.8	6.6
40.	Face length	11.6	.5	5.1
41.	Head breadth	15.3	.6	4.4
42.	Head circumference	54.4	1.3	2.4
43.	Interpupillary distance	6.1	.3	6.5
44.	Face breadth	14.3	.6	4.6
	Hand Measurements			
45.	Hand length	18.1	.7	4.2
46.	Palm length	10.3	.5	5.2
47.	Hand breadth	8.5	.4	4.9
48.	Hand circumference	20.8	1.2	6.2
	Foot Measurements			
49.	Foot length	24.4	1.3	5.4
50.	Instep length	17.9	2.0	11.5
51.	Foot breadth	9.6	.4	4.6
52.	Ball foot circumference	24.6	1.1	4.8
53.	Heel breadth	6.5	.3	6.0
54.	Heel-ankle circumference	31.9	1.9	6.2

N = 3,747

TABLE 1-10. STATISTICAL VALUES OF WEIGHT AND SKIN-FOLD THICKNESS
(values in centimeters)

		Mean	Standard Deviation	Coefficient of Variation
	Weight			
55.	Weight in kilograms	58.7 ~~59.4~~	4.9	8.2
	Skin-Fold Thickness			
56.	Juxta-nipple	.40	.14	35.2
57.	Sub-scapular	.77	.20	26.9
58.	Mid-axillary	.44	.13	28.9
59.	Triceps	.53	.17	33.4

N = 3,747

B. DEMOGRAPHIC RESULTS

The section which follows contains summary statistics of the demographic results of the study.

1. Age

Table 1-11 summarizes information on age of the men measured in Korea. Table 1-12 details the distribution of age.

The range of the total series was from age 17 to 41. Army personnel covered the full range, while the samples from the other services did not. Navy men ranged from age 18 to 41, Marines from 17 to 32, and those from the Air Force from 18 to 32.

The mean age (rounded to the nearest full year) for men in the Army and Air Forces was the same as the mean of the total series: 23. The mean age of Marines was lower, 21, but that of Navy men strikingly higher at 27.

TABLE 1-11. SUMMARY OF AGE

	Army	Navy	Marine Corps	Air Force	Total Series
Range (years)	17-41	18-41	17-32	18-32	17-41
Mean (years)*	23	27	21	23	23
S.D. (years)**	2.1	6.0	3.8	2.2	2.6
V(%)**	9.1	22.2	18.1	9.6	11.3
Number of men	3249	141	167	190	3747

* to nearest year
** to nearest tenth

TABLE 1-12. DISTRIBUTION OF AGE

Age (years)	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
17	2	.06	0	.00	2	1.20	0	.00	4	.11
18	16	.49	1	.71	5	2.99	1	.53	23	.61
19	37	1.14	4	2.84	7	4.19	10	5.26	58	1.55
20	99	3.05	5	3.55	32	19.16	18	9.47	154	4.11
21	582	17.91	7	4.96	44	26.35	35	18.42	668	17.83
22	905	27.85	13	9.22	35	20.96	45	23.68	998	26.63
23	822	25.30	9	6.38	22	13.17	29	15.26	882	23.54
24	325	10.00	20	14.18	5	2.99	21	11.05	371	9.90
25	209	6.43	2	1.42	1	.60	10	5.26	222	5.92
26	86	2.65	9	6.38	1	.60	8	4.21	104	2.78
27	53	1.63	7	4.96	1	.60	5	2.63	66	1.76
28	31	.95	6	4.26	0	.00	3	1.58	40	1.07
29	26	.80	8	5.67	1	.60	2	1.05	37	.99
30	9	.28	8	5.67	1	.60	0	.00	18	.48
31	7	.22	6	4.26	0	.00	0	.00	13	.35
32	5	.15	10	7.09	1	.60	1	.53	17	.45
33	1	.03	9	6.38	0	.00	0	.00	10	.27
34	2	.06	0	.00	0	.00	0	.00	2	.05
35	1	.03	8	5.67	0	.00	0	.00	9	.24
36	1	.03	2	1.42	0	.00	0	.00	3	.08
37	0	.00	2	1.42	0	.00	0	.00	2	.05
38	1	.03	0	.00	0	.00	0	.00	1	.03
40	0	.00	2	1.42	0	.00	0	.00	2	.05
41	1	.03	1	.71	0	.00	0	.00	2	.05
No response	28	.86	2	1.42	9	5.40	2	1.05	41	.99
Totals	3249		141		167		190		3747	

Only 4.74% of Army personnel were from ages 17 to 20. The majority of Army men (53.15%) were either 22 or 23. Few of the Navy were likewise under age 21 (7.1%), but the distribution of age showed much more heterogeneity. By contrast, 27.54% of the Marines were under 21 (19.16% at age 20), and the next 60.48% were from age 21 to 23. The Air Force had 15.26% under age 21, with 68.41% from 21 to 24.

2. Geographical Distribution

Place of birth and place of longest residence were determined from the entire sample. Geographically speaking, there were three different classes: provinces, cities, and foreign countries. If a subject was born and/or lived longest in Seoul or Pusan, this is where he is reported; if he was born and/or lived longest somewhere else in Korea he is reported in the appropriate province; a few reported birth and/or place of longest residence to be in China or Japan. The fourteen provinces of Korea are listed on tables 1-13 and 1-14 in descending order from the northernmost province to Che-joo-do, the island province off the southern tip of the Korean mainland. The top five provinces are in North Korea, Kyung-gi-do and Kang-wan-do straddle the Demarcation Line and are in both North and South Korea; and the remaining seven provinces are in South Korea.

Slightly more than 1% of the sample indicated birthplace outside the Korean peninsula and less than 2% of the respondents reported having been born in North Korean Provinces. A little more than 15% reported birthplaces within the two provinces straddling the Demarcation Line, while the large majority, 82%, gave as their birthplaces locations within the South Korean Provinces.

a. Place of Birth

The large number of men from the Army again dominated the total series as shown in Table 1-13. Of Army personnel 18% were born in the southeast province of Kyong-sang Buk-do, as were 17% of the total. The Army total from the four other most prominent provinces was 50%, for a total of 68%.

Navy men, however, were reported 31% from the capital city of Seoul and its surrounding province of Kyung-gi, which lies between the 37° and 38° parallels. The Marines were almost identical with the Navy, and the Air Force reported 45% from that area. It may be noted that the large majority of the sample were born and lived longest in the rural communities of South Korea.

b. Place of Longest Residence

This element of the study was very similar to the distribution of place of birth. Those who reported a place of longest residence in the North Korean Provinces were less than .2 of 1% of the total sample. As was the case with "place of birth," slightly more than 15% of the sample indicated longest residence in one of the two provinces which straddle North and South Korea.

TABLE 1-13. PLACE OF BIRTH

Birthplace	Army No.	Army %	Navy No.	Navy %	Marine Corps No.	Marine Corps %	Air Force No.	Air Force %	Total No.	Total %
Provinces										
Pyung-an Buk-do	0	.00	0	.00	0	.00	0	.00	0	.00
Pyung-an Nam-do	7	.22	8	5.67	0	.00	10	5.26	25	.67
Ham-kyong Buk-do	1	.03	2	1.42	1	.60	2	1.05	6	.16
Ham-kyong Nam-do	5	.15	1	.71	1	.60	1	.53	8	.21
Hwang-Lai-do	11	.34	6	4.26	2	1.20	7	3.68	26	.69
Kang-wan-do	223	6.86	4	2.84	4	2.40	3	1.58	234	6.24
Kyung-gi-do	263	8.09	19	13.48	32	19.16	27	14.21	341	9.10
Choong-chung Buk-do	216	6.65	7	4.96	9	5.39	10	5.26	242	6.46
Kyong-sang Buk-do	591	18.19	13	9.22	21	12.57	18	9.47	643	17.16
Choong-chung Nam-do	384	11.82	8	5.67	12	7.19	20	10.53	424	11.32
Kyong-sang Nam-do	361	11.11	13	9.22	19	11.38	13	6.84	406	10.84
Cholla Buk-do	426	13.11	9	6.38	12	7.19	5	2.63	452	12.06
Cholla Nam-do	465	14.31	13	9.22	18	10.78	6	3.16	502	13.40
Che-joo-do	68	2.09	1	.71	4	2.40	2	1.05	75	2.00
Major Korean Cities										
Seoul	153	4.71	26	18.44	21	12.57	58	30.53	258	6.89
Pusan	45	1.39	5	3.55	6	3.59	4	2.11	60	1.60
Foreign Countries										
China	3	.09	0	.00	1	.60	0	.00	4	.11
Japan	26	.80	6	4.26	4	2.40	4	2.11	40	1.07
Other	1	.03	0	.00	0	.00	0	.00	1	.03
Totals	3249		141		167		190		3747	

TABLE 1-14. PLACE OF LONGEST RESIDENCE

Residence	Army No.	Army %	Navy No.	Navy %	Marine Corps No.	Marine Corps %	Air Force No.	Air Force %	Total No.	Total %
Provinces										
Pyung-an Buk-do	0	.00	0	.00	0	.00	0	.00	0	.00
Pyung-an Nam-do	0	.00	2	1.42	0	.00	0	.00	2	.05
Ham-kyong Buk-do	1	.03	0	.00	0	.00	0	.00	1	.03
Ham-kyong Nam-do	0	.00	1	.71	0	.00	1	.53	2	.05
Hwang-Lai-do	0	.00	1	.71	0	.00	0	.00	1	.03
Kang-wan-do	223	6.86	3	2.13	7	4.19	4	2.11	237	6.33
Kyung-gi-do	268	8.25	16	11.35	35	20.96	24	12.63	343	9.15
Choong-chung Buk-do	211	6.49	6	4.26	10	5.99	7	3.68	234	6.24
Kyong-sang Buk-do	561	17.27	13	9.22	19	11.38	18	9.47	611	16.31
Choong-chung Nam-do	412	12.68	7	4.96	12	7.19	19	10.00	450	12.01
Kyong-sang Nam-do	362	11.14	13	9.22	20	11.98	12	6.32	407	10.86
Cholla Buk-do	399	12.28	7	4.96	13	7.78	6	3.16	425	11.34
Cholla Nam-do	431	13.27	12	8.51	16	9.58	6	3.16	465	12.41
Che-joo-do	71	2.19	2	1.42	5	2.99	1	.53	79	2.11
Major Korean Cities										
Seoul	228	7.02	45	31.91	24	14.37	86	45.26	383	10.22
Pusan	2	.06	3	2.13	0	.00	0	.00	5	.13
Foreign Countries										
China	80	2.46	10	7.09	6	3.59	6	3.16	102	2.72
Japan	0	.00	0	.00	0	.00	0	.00	0	.00
Other	0	.00	0	.00	0	.00	0	.00	0	.00
Totals	3249		141		167		190		3747	

3. Education

Tables 1-15 and 1-16 illustrate in detail the educational levels attained by the men in the various services. It will be noted that the mean for the Army (8.5) is considerably lower than for the other branches. The mean for Naval personnel is 12.8 years, for the Marines 13.9 years, and for the Air Force 13.6 years. The over-all mean is 9.2 years.

The mode for each branch is clearly delineated: 6 years for the Army (39.83%), 12 years for the Navy (51.77%), 12 years for the Marines (37.13%), and 12 years for the Air Force (35.79%).

Only 7.69% of the total completed less than 6 years education.

4. Religion

Table 1-17 lists the religions offered for response in the study. The largest category reported was Christianity, with 16%. Buddhism was the next largest single response, with 13%. A large majority, 65%, chose to report under "other," and frequently made specific comment in the adjacent space. Due to the limitations of this study interpretations of these comments, which were in Korean, were not made. This category must stand for the present as an unanswered item of interest.

5. Marital Status

Table 1-18 illustrates the heavy proportion of single men in the Army, Marines, and Air Force: 90 to almost 96%. Men of the Navy, with a mean age of four years older (27) than the others, had only 56% of their number single.

TABLE 1-15. EDUCATION

Years of Education	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
0	154	4.74	1	.71	6	3.59	7	3.68	168	4.48
1	8	.25	0	.00	0	.00	0	.00	8	.21
2	55	1.69	0	.00	0	.00	0	.00	55	1.47
3	25	.77	0	.00	0	.00	0	.00	25	.67
4	17	.52	0	.00	2	1.20	0	.00	19	.51
5	12	.37	0	.00	1	.60	0	.00	13	.35
6	1294	39.83	0	.00	3	1.80	3	1.58	1300	34.69
7	26	.80	0	.00	1	.60	0	.00	27	.72
8	108	3.32	1	.71	1	.60	0	.00	110	2.94
9	823	25.33	12	8.51	31	18.56	6	3.16	872	23.27
10	10	.31	3	2.13	3	1.80	1	.53	17	.45
11	33	1.02	8	5.67	1	.60	2	1.05	44	1.17
12	421	12.96	73	51.77	62	37.13	68	35.79	624	16.65
13	21	.65	4	2.84	1	.60	14	7.37	40	1.07
14	52	1.60	14	9.93	3	1.80	45	23.68	114	3.04
15	40	1.23	4	2.84	5	2.99	27	14.21	76	2.03
16	43	1.32	12	8.51	3	1.80	14	7.37	72	1.92
17	1	.03	0	.00	0	.00	1	.53	2	.05
18	1	.03	5	3.55	1	.60	0	.00	7	.19
19	4	.12	0	.00	0	.00	0	.00	4	.11
20	6	.18	1	.71	11	6.59	0	.00	18	.48
No response	95	2.92	3	2.13	32	19.16	2	1.05	132	3.52
Totals	3249		141		167		190		3747	

TABLE 1-16. SUMMARY OF EDUCATION
(in years)

	Army	Navy	Marine Corps	Air Force	Total
Range	0-20	0-20	0-20	0-20	0-20
Mean	8.5	12.9	13.9	13.6	9.2
S.D.	4.7	2.9	5.3	5.9	5.0
Number of Men	3249	141	167	190	3747

TABLE 1-17. RELIGION

Religion	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Buddhism	432	13.30	24	17.02	23	13.77	15	7.89	494	13.18
Confucianism	89	2.74	4	2.84	6	3.59	1	.53	100	2.67
Christianity	461	14.19	39	27.66	28	16.77	64	33.68	592	15.80
Chondokyo	77	2.37	5	3.55	3	1.80	0	.00	85	2.27
Shamanism	2	.06	0	.00	0	.00	0	.00	2	.05
Shintoism	5	.15	0	.00	0	.00	0	.00	5	.13
Bark Chang-no Kyo	25	.77	0	.00	0	.00	0	.00	25	.67
Sokka Gukkai	1	.03	0	.00	0	.00	0	.00	1	.03
Other	2153	66.27	69	48.94	106	63.47	110	57.89	2438	65.07
No response	4	.12	0	.00	1	.60	0	.00	5	.13
Totals	3249		141		167		190		3747	

TABLE 1-18. MARITAL STATUS

Status	Army No.	Army %	Navy No.	Navy %	Marine Corps No.	Marine Corps %	Air Force No.	Air Force %	Total No.	Total %
No response	40	1.23	1	.71	1	.60	3	1.58	45	1.20
Single	2925	90.03	80	56.74	160	95.81	179	94.21	3344	89.24
Married	283	8.71	60	42.55	6	3.59	8	4.21	357	9.53
Other	1	.03	0	.00	0	.00	0	.00	1	.03
Totals	3249		141		167		190		3747	

6. Occupation

a. Civilian Occupation

Table 1-19 confirms informal observation on the distribution of occupations in Korea. About half the population of the study had been involved in farming prior to induction. Another 16.65% had been students, while 15.51% were in "commerce." Other occupations were represented in much smaller percentages. The "fire field" category represents a nomadic farmer who travels from place to place, first burning the debris from an area of land, planting a crop, harvesting same, and then moving to another area where the cycle is repeated.

b. Father's Occupation

As shown on Table 1-20, a large majority (67.52%) of the fathers of the men in this study were farmers. As for "commerce," an almost identical number (16.60%) of fathers were so engaged as were sons prior to the sons' induction (See Table 1-19). There seemed to be no other outstanding occupation.

TABLE 1-19. OCCUPATION

Occupation	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Farming	1650	50.78	4	2.84	23	13.77	5	2.63	1682	44.89
Commerce	545	16.77	2	1.42	27	16.17	7	3.69	581	15.51
Student	292	8.99	115	81.56	65	38.92	152	80.00	624	16.65
Other	188	5.79	6	4.26	33	19.76	11	5.79	238	6.35
Technician	162	4.99	4	2.84	10	5.99	7	3.68	183	4.88
Factory work	156	4.80	2	1.42	7	4.19	2	1.05	167	4.46
Office work	95	2.92	7	4.96	2	1.20	4	2.11	108	2.88
Fire fields	83	2.55	0	.00	0	.00	0	.00	83	2.22
Professional	35	1.08	0	.00	0	.00	0	.00	35	.93
Fishing	29	.89	0	.00	0	.00	0	.00	29	.77
Teacher	14	.43	1	.71	0	.00	2	1.05	17	.45
Totals	3249		141		167		190		3747	

TABLE 1-20. FATHER'S OCCUPATION

Occupation	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
Farming	2351	72.36	54	38.30	70	41.92	55	28.95	2530	67.52
Commerce	456	14.04	46	32.62	56	33.53	64	33.68	622	16.60
Factory work	232	7.14	14	9.93	19	11.38	11	5.79	276	7.37
Other	75	2.31	14	9.93	9	5.39	41	21.58	139	3.71
Teacher	44	1.35	5	3.55	6	3.59	11	5.79	66	1.76
Fishing	35	1.08	0	.00	0	.00	0	.00	35	.93
Professional	32	.98	2	1.42	2	1.20	1	.53	37	.99
Technician	16	.49	5	3.55	1	.60	5	2.63	27	.72
Student	8	.25	1	.71	4	2.40	2	1.05	15	.40
Office Work	0	.00	0	.00	0	.00	0	.00	0	.00
Fire fields	0	.00	0	.00	0	.00	0	.00	0	.00
Totals	3249		141		167		190		3747	

7. Military Branch

Table 1-21 illustrates that 70% of the Army subjects belonged to the infantry, and another 12% to the artillery. The structure of the data collection instrument did not permit the acquisition of similar data for Navy, Air Force, and Marines.

8. Rank

The bulk of the men studied (40.89%) had a rank of PFC or its equivalent. Another 18.23% were one rank under PFC, while 22.42% were one rank above. These proportions held fairly true for each of the services except the Navy, where the mode (29.08%) fell at the rank equivalent to Sergeant First Class. The next two most frequent ranks were one below (21.28%) and one above (14.18%). Table 1-22 details this phase of the study.

9. Length of Service

The majority of men in this study (50.39%) had been in the military less than a year, as is shown on Table 1-23. Almost a quarter (23.30%) had between one and two years' experience, and another fifth (19.72%) had been in from two to three years. There were very few (6.59%) who had served more than three years. The sample from the Navy provided most of these more experienced men.

10. Combat Experience

As shown in Table 1-24, less than 2% of the men of the Army, Marines, and Air Force reported having had combat experience. Of Naval personnel 12% did report such experience. This is in harmony with the ages of the men studied, and attention is invited to Table 1-1.

TABLE I-21. MILITARY BRANCHES OF ARMY

Branch	Army No.	Army %
Infantry	2290	70.48
Medical	96	2.95
Airborne	1	.03
Artillery	391	12.03
Engineer	93	2.86
Signal	98	3.02
Military Police	13	.40
Quartermaster	70	2.15
Transportation	120	3.69
Other	77	2.37
Total	3249	

TABLE I-22. RANK

Rank	Army No.	Army %	Navy No.	Navy %	Marine Corps No.	Marine Corps %	Air Force No.	Air Force %	Total No.	Total %
Trainee	40	1.23	1	.71	0	.00	2	1.05	43	1.15
Private	627	19.30	10	7.09	23	13.77	23	12.11	683	18.23
PFC	1421	43.74	5	3.55	50	29.94	56	29.47	1532	40.89
Corporal	762	23.45	3	2.13	46	27.54	29	15.26	840	22.42
Sergeant	282	8.68	9	6.38	21	12.57	34	17.89	346	9.23
Staff sergeant	2	.06	30	21.28	0	.00	3	1.58	35	.93
SFC	115	3.54	41	29.08	25	14.97	31	16.32	212	5.66
Master sergeant	0	.00	20	14.18	1	.60	0	.00	21	.56
Warrant Officer	0	.00	5	3.55	0	.00	0	.00	5	.13
Officer	0	.00	17	12.06	1	.60	12	6.32	30	.80
Totals	3249		141		167		190		3747	

TABLE 1-23. LENGTH OF SERVICE

Years of Service	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
0	1716	52.83	14	9.93	93	55.67	65	34.21	1888	50.39
1	786	24.19	9	6.38	27	16.17	51	26.84	873	23.30
2	660	20.31	22	15.60	22	13.17	35	18.42	739	19.72
3	6	.18	10	7.09	5	2.99	9	4.74	30	.80
4	34	1.05	8	5.67	1	.60	11	5.79	54	1.44
5	5	.15	6	4.26	2	1.20	8	4.21	21	.56
6	3	.09	5	3.55	2	1.20	4	2.11	14	.37
7	3	.09	7	4.96	1	.60	1	.53	12	.32
8	2	.06	6	4.26	3	1.80	2	1.05	13	.35
9	1	.03	7	4.96	2	1.20	0	.00	10	.27
10	3	.09	8	5.67	2	1.20	2	1.05	15	.40
11	5	.15	5	3.55	1	.60	0	.00	11	.29
12	4	.12	9	6.38	0	.00	1	.53	14	.37
13	0	.00	3	2.13	0	.00	0	.00	3	.08
14	0	.00	9	6.38	0	.00	0	.00	9	.24
15	1	.03	4	2.84	0	.00	0	.00	5	.13
16	0	.00	4	2.84	0	.00	0	.00	4	.11
17	0	.00	0	.00	0	.00	0	.00	0	.00
18	1	.03	2	1.42	0	.00	0	.00	3	.08
19	3	.09	1	.71	0	.00	0	.00	4	.11
20	6	.18	1	.71	2	1.20	0	.00	9	.24
21	10	.31	1	.71	4	2.40	1	.53	16	.43
Totals	3249		141		167		190		3747	

TABLE 1-24. COMBAT EXPERIENCE

Months of Combat	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
0	3216	98.98	124	87.94	166	99.40	189	99.47	3695	98.61
1	3	.09	0	.00	1	.60	0	.00	4	.11
2	2	.06	0	.00	0	.00	0	.00	2	.05
3	3	.09	2	1.42	0	.00	0	.00	5	.13
4	2	.06	0	.00	0	.00	1	.53	3	.08
5	2	.06	0	.00	0	.00	0	.00	2	.05
6	2	.06	1	.71	0	.00	0	.00	3	.08
8	2	.06	2	1.42	0	.00	0	.00	4	.11
9	3	.09	0	.00	0	.00	0	.00	3	.08
10	2	.06	2	1.42	0	.00	0	.00	4	.11
11	3	.09	0	.00	0	.00	0	.00	3	.08
12	0	.00	4	2.84	0	.00	0	.00	4	.11
More than 12	9	.28	6	4.26	0	.00	0	.00	15	.40
Totals	3249		141		167		190		3747	

11. Military Service Status

As illustrated in Table 1-25, the great majority of the men were drafted into military service. More than 96% of men in the Army, 83% of Marines, and 75% in the Air Force were so inducted. The exception is the Navy, in which over 79% of those involved in this study can be classified as professionals.

TABLE 1-25. MILITARY SERVICE STATUS

Status	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
No response	75	2.31	2	1.42	2	1.20	3	1.58	82	2.19
Professional	34	1.05	112	79.43	26	15.57	42	22.11	214	5.71
Drafted	3131	96.37	26	18.44	139	83.23	143	75.26	3439	91.78
Other	9	.28	1	.71	0	.00	2	1.05	12	.32
Totals	3249		141		167		190		3747	

12. Handedness

More than 93% of the men reported that they were right-handed. All branches reported left-handedness close to the total mean of 2.67% with the exception of the Air Force, in which 5.79% so listed themselves. No response was obtained for 46.11% of the Marines. Different interviewers were used for the various branches of the military service. It is assumed that the deviate pattern of recorded responses attributable to the marines is a result of interviewer bias. Nearly 50% of the marines are reported as having given no response, as compared to less than 2% of the soldiers in the other services. Either the interviewer did not make the item clear enough to the respondents, or he recorded their responses improperly. The pattern of responses suggests the former

as more likely to be true. Table 1-26 illustrates this element of the study in detail.

TABLE 1-26. HANDEDNESS

	Army		Navy		Marine Corps		Air Force		Total	
	No.	%	No.	%	No.	%	No.	%	No.	%
No response	51	1.57	1	.71	77	46.11	3	1.58	132	3.52
Right handed	3116	95.91	136	96.45	87	52.10	176	92.63	3515	93.81
Left handed	82	2.52	4	2.84	3	1.80	11	5.79	100	2.67
Totals	3249		141		167		190		3747	

C. BODY MEASUREMENT CORRELATIONS

If body measurements were directly proportional to each other for all subjects anthropometric surveys would require but one measurement per subject. If a perfect correlation existed between all body measures one body measure from a subject would predict the remaining 58 with 100% accuracy. Unfortunately, such a perfect correlation or relationship does not exist. The relative strengths between body measure relationships were examined in this study and are herein reported.

Generally speaking, strength of relationship appears to be a function of measurement homogeneity. Body heights are highly correlated with other body heights and lengths, widths with widths, and circumferences with circumferences.

TABLE 1-27. BODY MEASUREMENT CORRELATIONS

	1	2	3	4	5
1 - Stature					
2 - Shoulder height	.79				
3 - Waist height	.70	.68			
4 - Crotch height	.64	.61	.69		
5 - Knee-cap height	.58	.60	.60	.50	
6 - Popliteal height	.38	.41	.36	.35	.37

Note in Table 1-27 that as the number of variables which comprise stature are reduced, the strength of the correlation is likewise reduced.

Stature is highly correlated with the length of limbs and their segments as noted in Table 1-28.

TABLE 1-28. CORRELATION COEFFICIENTS FOR STATURE vs LIMB LENGTHS

Lengths	Stature
Arm reach forward	.45
Buttock-knee	.53
Buttock-popliteal	.45
Shoulder-elbow	.38
Forearm-hand	.52
Foot	.39
Sleeve	.48
Hand	.53

Table 1-29 indicates that weight and girth are highly correlated. Circumferences, with the exception of head circumference, show strong relationships to weight indicating that heavy subjects tend to have large girths from top to bottom and light weight subjects have small girths.

TABLE 1-29. CORRELATION COEFFICIENTS FOR WEIGHT vs CERTAIN CIRCUMFERENCES

	1	2	3	4	5
1 - Weight					
2 - Crotch-thigh	.67				
3 - Chest	.61	.47			
4 - Hip	.67	.54	.47		
5 - Shoulder	.57	.49	.63	.47	
6 - Waist	.58	.47	.40	.47	.38

In nearly every instance where different classes of measures are correlated with one another the relationships range from weak to non-existent. Skin fold thickness, head, hand, and face measures, do not predict stature. There is a very weak relationship between circumference and length of limbs.

In short, even the strongest relationships are not adequate to permit the prediction of one measure from another if close tolerances are required.

D. COMPARISON OF MEAN BODY DIMENSIONS BETWEEN ROK MILITARY BRANCHES

There is a striking difference in weight and height between the ROK services. Navy personnel are taller than personnel from the other branches while army subjects were generally the shortest and the lightest. The navy sample consists of a higher percentage of senior officers than the other branches. Consequently, their mean age is 27 years compared to the total samples mean of 23 years. This striking difference in age easily accounts for the difference in weight between army and navy inasmuch as there is such a high correlation between age and weight. Although this same logic does not hold for a comparison between navy and marines, who have identical mean weights but differ significantly in age, a more careful examination reveals that weight is distributed differently. Marines have bigger chests, necks, arms, and calves, but smaller waists. These differences might be attributed to similar diets (between army and navy) but dissimilar work requirements.

The personnel of the air force and navy are significantly taller than those of the marines and army. Service diet and occupations are not likely to be contributing factors to this difference which suggests the involvement of selection factors.

TABLE I-30. COMPARISON OF MEAN BODY DIMENSIONS OF ROK MILITARY BRANCHES
(values in centimeters)

		Army N=3249	Navy N=141	Marines N=167	Air Force N=190
1.	Stature	158.8	166.3	163.9	165.9
2.	Shoulder height	129.0	134.2	134.3	134.5
3.	Waist height	98.8	97.2	101.1	96.3
4.	Crotch height	74.0	75.0	72.2	75.8
5.	Kneecap height	46.0	47.2	45.8	47.3
6.	Chest depth, standing	21.7	22.1	22.4	22.0
7.	Chest breadth, standing	28.8	29.4	29.8	29.5
8.	Hip breadth, standing	30.3	31.3	30.9	30.9
9.	Sitting height	87.7	87.2	87.9	87.6
10.	Eye height, sitting	75.4	76.9	77.4	78.0
11.	Shoulder height, sitting	57.3	58.3	57.2	57.3
12.	Shoulder-elbow length	33.6	34.1	33.9	30.9
13.	Forearm-hand length	43.4	44.3	43.9	40.6
14.	Buttock-knee length	53.2	55.5	55.1	52.9
15.	Buttock-popliteal length	42.6	44.6	44.1	42.0
16.	Knee height, sitting	47.5	48.1	37.7*	47.9
17.	Popliteal height	38.8	38.5	26.9*	38.1
18.	Shoulder breadth	42.2	43.4	42.9	42.0
19.	Elbow-to-elbow breadth	39.8	42.0	41.1	40.6
20.	Hip breadth, sitting	31.8	33.2	33.4	32.1
21.	Arm reach, upward	129.7	131.0	130.1	132.0
22.	Arm reach, forward	79.7	82.0	81.7	80.7
23.	Neck circumference	34.0	35.0	35.1	34.6
24.	Shoulder circumference	114.2	108.6	106.5	110.8
25.	Chest circumference	93.5	96.9	92.0	95.1
26.	Waist circumference	73.7	74.0	72.8	71.0
27.	Hip circumference	90.1	93.3	94.8	95.0
28.	Upper arm circumference	25.2	25.4	25.6	25.3
29.	Wrist circumference	16.4	16.6	16.5	16.2
30.	Crotch thigh circumference	48.6	47.6	49.1	49.0
31.	Lower thigh circumference	37.7	39.0	38.3	37.7
32.	Calf circumference	34.3	33.3	34.5	34.4
33.	Ankle circumference	21.4	21.3	22.0	21.2
34.	Back waist length	45.4	47.5	45.2	45.5
35.	Interscye	37.7	38.7	38.7	36.4
36.	Sleeve inseam	44.5	45.5	42.8	45.5
37.	Sleeve length	78.5	79.7	78.2	76.8
38.	Head length	17.8	17.7	17.7	17.7
39.	Head height	12.5	12.3	12.9	12.2
40.	Face length	11.5	12.2	12.0	11.8
41.	Head breadth	15.0	15.4	15.4	15.4
42.	Head circumference	53.9	53.9	54.4	54.0

* Inconsistent Data

TABLE 1-30. COMPARISON OF MEAN BODY DIMENSIONS
OF ROK MILITARY BRANCHES - Continued
(values in centimeters)

	Army N=3249	Navy N=141	Marines N=167	Air Force N=190
43. Interpupiliary distance	6.0	6.3	5.9	6.1
44. Face breadth	14.0	14.3	14.1	14.4
45. Hand length	17.9	17.9	17.7	17.7
46. Palm length	11.2	10.3	10.8	10.4
47. Hand breadth	8.8	12.5*	8.9	8.7
48. Hand circumference	20.6	20.8	21.0	20.3
49. Foot length	24.1	24.2	23.2	23.9
50. Instep length	17.7	16.7	20.0	19.4
51. Foot breadth	9.6	9.6	9.6	10.6
52. Ball foot circumference	24.4	23.3	24.4	24.1
53. Heel breadth	6.4	6.4	6.3	6.4
54. Heel-ankle circumference	31.5	30.7	31.7	31.7
55. Weight in kilograms	58.8	60.1	60.1	59.4
56. Juxta-nipple skinfold	.44	.49	.53	.47
57. Sub-scapulary skinfold	.86	1.00	.76	.88
58. Mid-axillary skinfold	.48	.55	.54	.51
59. Triceps skinfold	.54	.48	.70	.57

*Inconsistant data

E. COMPARISON OF MEAN BODY DIMENSIONS BETWEEN ROKA AND USA

Of the 59 body measurements taken from Korean soldiers, 39 were comparable with data collected from U.S. troops and the comparisons are displayed in Table 1-31. The means of U. S. troops exceeded those of Korean troops on 33 measures, 27 of which were statistically significant differences. The means of Korean troops exceeded those of USA troops on 6 measures, 3 of which were significant differences, making a total of 30 measures on which there were significant differences.

In general terms the Koreans may be characterized as being smaller in stature, shorter in limb, lighter, and have a smaller percentage of body fat than U.S. soldiers. Korean soldiers have rounder heads and broader and thicker chests.

TABLE 1-31. MEAN COMPARISONS OF ROK & USA BODY MEASURES
(values in centimeters)

	ROK	USA	Differences
ROK Means Significantly Larger Than USA Means			
Chest depth, standing	21.8	21.2	.6*
Chest breadth, standing	29.0	28.3	.7*
Head breadth	15.4	15.2	.2
USA Means Significantly Larger Than ROK Means			
Stature	165.3	173.9	8.6
Shoulder height	134.2	149.2	15.0
Waist height	98.8	105.6	6.8
Crotch height	75.1	83.4	8.3
Shoulder-elbow length	33.6	36.3	2.7
Forearm-hand length	44.0	47.6	3.6
Buttock-knee length	53.8	59.4	5.6
Knee height, sitting	48.7	54.9	6.2*
Shoulder breadth	42.5	45.6	3.1
Elbow-to-elbow breadth	40.3	44.6	4.3
Hip breadth, sitting	32.2	35.4	3.2*
Neck circumference	34.4	36.7	2.3
Hip circumference	87.5	93.1	5.6*
Upper arm circumference	25.6	28.0	2.4
Wrist circumference	16.5	17.0	.5*
Crotch thigh circumference	49.1	54.5	5.4*
Ankle circumference	21.6	26.3	4.7*
Head length	18.0	19.5	1.5*
Head height	12.6	13.1	.5*
Face length	11.7	12.5	.8*
Head circumference	54.5	56.6	2.1
Hand length	18.1	19.3	1.2*
Hand breadth	8.5	8.7	.2*
Foot length	24.5	26.5	2.0*
Foot breadth	9.6	9.8	.2*
Heel breadth	6.5	6.7	.2*
Weight (in kilograms)	59.5	70.2	10.7*
Means Not Significantly Different			
Sitting height	89.0	90.9	1.9
Chest circumference	88.5	92.4	3.9
Waist circumference	74.3	77.7	3.4
Lower thigh circumference	38.3	37.4	.9
Calf circumference	34.6	35.8	1.2
Interscye	37.9	37.6	.3
Sleeve length	79.4	81.0	1.6
Instep length	17.9	19.3	1.4
Ball foot circumference	24.7	24.6	.1

*Indicates a significant difference at the .01 level of confidence. All other significant differences at .05.

F. COMPARISON OF MEAN BODY DIMENSIONS BETWEEN ROK, USA, THAI, AND VIETNAMESE TROOPS

Table 1-32 compares means of ROK, USA, Thai, and Vietnamese soldiers on 36 body measures. U. S. troops are characterized as largest on most dimensions, with ROK, Thai, and Vietnamese following in that order. The ROK and Thai soldiers are very close, rarely differing from one another by more than a centimeter. Stature and chest circumference are a couple of measures in which large differences occur. The Vietnamese soldiers are considerably smaller than their Asian neighbors on most of the dimensions.

TABLE 1-32. COMPARISON OF CERTAIN MEAN BODY DIMENSIONS OF USA, ROK, THAI AND VIETNAMESE TROOPS
(values in centimeters)

	USA	ROK	Thai	Vietnamese
Standing Measurements				
Stature	173.9	165.3	163.4	160.5
Shoulder height	149.2	134.2	134.3	131.4
Waist height	105.6	98.8	99.0	92.8
Crotch height	83.4	75.1	75.3	73.9
Sitting Measurements				
Sitting height	90.9	~~89.0~~ 87.7	86.4	85.0
Shoulder-elbow length	36.3	33.3	34.9	33.9
Forearm-hand length	47.6	44.0	45.7	44.6
Buttock-knee length	59.4	53.8	53.8	52.7
Knee height	54.9	48.7	50.8	47.9
Shoulder breadth	45.6	42.5	41.6	40.9
Hip breadth	35.4	32.2	31.8	30.3

TABLE 1-32. COMPARISON OF CERTAIN MEAN BODY DIMENSIONS OF USA, ROK, THAI AND VIETNAMESE TROOPS - Continued
(values in centimeters)

	USA	ROK	Thai	Vietnamese
Body Circumferences				
Neck	36.7	34.4	33.8	33.8
Chest	92.4	88.5	85.0	81.1
Waist	77.7	74.3	69.7	67.7
Hip	93.1	87.5	86.3	82.9
Upper arm	28.0	25.6	26.0	24.1
Wrist	17.0	16.5	15.7	14.9
Crotch-thigh	54.5	49.1	49.5	47.7
Lower thigh	37.4	38.3	38.1	35.3
Calf	35.8	34.6	34.2	32.5
Ankle	26.3	21.6	21.0	20.1
Surface Measurements				
Interscye	37.6	37.9	35.3	36.0
Sleeve length	81.0	79.4	78.1	77.6
Head Measurements				
Length	19.5	18.0	17.9	18.2
Height	13.1	12.6	12.8	12.3
Face length	12.5	11.7	11.4	11.3
Breadth	15.2	15.4	15.2	14.9
Circumference	56.6	54.5	54.0	54.2
Hand Measurements				
Length	19.3	18.1	18.0	17.6
Breadth	8.7	8.5	8.5	8.0
Foot Measurements				
Length	26.5	24.5	24.6	23.7
Instep length	19.3	17.9	17.9	17.1
Breadth	9.8	9.6	10.0	9.3
Ball foot circumference	24.6	24.7	24.8	24.2
Heel breadth	6.7	6.5	6.5	6.2
Weight				
Weight in kilograms	70.2	~~59.5~~ 58.9-129.6 130.9	56.3	51.1

G. EQUIPMENT EVALUATIONS

Attitudes of army personnel were studied by use of a scale of seven points. At point one the men expressed difficulty with an item, while at point seven they expressed ease of handling. A neutral attitude, in which they reported neither particular difficulty nor particular ease, was expressed at point four on the continuum.

Questions were asked concerning their attitudes on each of five items of equipment: the M-1 rifle and the carbine, the 2-1/2 ton and the 1/4 ton truck, and the steel helmet. The object of this part of the study was to determine if any correlation existed between the attitudes of the men and the equipment which had been supplied by the United States.

More than 3000 men responded to the questions on the weapons and the helmet. The mean score on the scale for the M-1 rifle was 2.9, an expression of general difficulty. The score for the carbine, a smaller weapon, was 5.0, which signifies relative ease. The steel helmet was rated at 3.7 for overall acceptability, an expression of some dissatisfaction.

The number of men responding to the questions on the trucks was near 600. A near neutral attitude (4.1) was reported for the 2-1/2 ton truck. A definite preference (4.5) however was shown for the 1/4 ton truck.

TABLE 1-33. EQUIPMENT EVALUATION MEANS OF KOREAN TROOPS AS EXPRESSED TOWARD VARIOUS ITEMS OF U. S. EQUIPMENT

	Item	Number	Standard Deviation	Mean	Overall Mean
M-1 rifle	(grasping stock	3189	1.7	2.9)	2.9
	(reaching trigger	3157	1.9	3.2)	
	(sighting	3140	1.7	2.6)	
Carbine	(grasping stock	3090	1.9	5.0)	5.0
	(reaching trigger	3050	1.8	5.2)	
	(sighting	3036	1.9	4.9)	
2-1/2 ton truck	(reaching accelerator	632	2.1	4.0)	4.1
	(vision	602	2.1	4.1)	
	(steering	559	2.0	4.1)	
1/4 ton truck	(reaching accelerator	538	2.1	4.6)	4.5
	(vision	537	2.1	4.7)	
	(steering	559	2.1	4.3)	
Helmet	(vision	3066	2.0	3.7)	3.7
	(fit	3089	2.0	3.7)	
	General "fit" of U.S. equipment	3026	2.2	--	3.5

It is interesting to note that the lighter, smaller equipment is generally more acceptable than the larger equipment. Tests of significance were computed in which measures for one piece of equipment were compared with the same measure on another piece of equipment. These comparisons are displayed in Table 1-34.

TABLE 1-34. COMPARISON OF EQUIPMENT EVALUATION MEANS

	M-1 Rifle	Carbine	Difference
Grasping stock	2.9	5.0	2.1
Reaching trigger	3.2	5.2	2.0
Sighting	2.6	4.9	2.3
	2-1/2 Ton Truck	**1/4 Ton Truck**	**Difference**
Reaching accelerator	4.0	4.6	.6
Vision	4.1	4.7	.6
Steering	4.1	4.3	.2
	Helmet	**Hypothetical Mean (Neutral)**	**Difference**
Vision	3.7	4.0	.3
Fit	3.7	4.0	.3

All differences are significant at the .01 level of confidence, except for steering, which is significant at the .02 level.

H. IMPLICATIONS OF THE DATA

1. Human Engineering

The data presented in this report may be of considerable value in the design and use of equipment for Korean military personnel. The utilization of information on the body size of Korean military personnel could be an important factor in improving the efficiency and performance of Korean man-equipment systems.

Sizing and space requirements for military equipment intended for use by the Republic of Korea Armed Forces can be developed from the body size data of this report. The specific information required will vary with the design problem under consideration, but most of the basic requirements with respect to body size are included within the 59 body dimensions taken during the survey.

Many human engineering problems in design, sizing, and adjustability involve the spatial requirements of the seated operator. Data on sitting height, eye height, shoulder height, and knee height, as well as shoulder and hip breadths, are required for the seated operator. Also of importance in this category are the arm reach measurements. Reliable data on all these items has been shown herein.

Considering the use of U. S. equipment by the Korean Armed Forces, some of the differences in body size between Korean and U. S. military personnel have been noted. The average weight of Korean military personnel is 59.5 kilograms, while U. S. Army men averaged 70.2 kilograms. This difference is of considerable importance with respect to the weight to be carried by the individual soldier. If it is assumed that the soldier's load should not exceed one-third of his body weight, it is apparent that the American could carry about 23.4 kilograms, on the average, whereas the Korean soldier would be limited to about 19.8.

The average height of Korean military personnel is 165.3 centimeters, as compared to 173.9 which is the average height of U. S. Army personnel. The difference in stature between Korean and U. S. military personnel is also reflected in the comparisons of other body proportions. While there is considerable difference between the two groups with respect to stature, the Koreans have a sitting height which is 89.0 while U. S. soldiers measure 90.9. This difference is not statistically significant. The U. S. soldier has longer limbs. These differences become important in human engineering considerations, since it is obvious that in operating U. S. equipment, the Korean cannot reach as far with his hands or his feet as the U. S. soldier.

Body girth and body breadth measurements are considerably smaller for Korean personnel escept for chest depth and breadth. In the two latter cases the Koreans have significantly larger chest measurements. Items of personal equipment intended for use by Koreans, such as load carrying suspenders and belts or parachute harnesses, must be capable of adjustment to accommodate these differences.

Tables 1-35 through 1-37 display the percentile comparisons between ROK and USA for stature, leg length, and forearm-hand length respectively. The "average" (50th percentile) Korean soldier is 165.3 centimeters in height and the "average" American soldier is 174.0 centimeters in height, a difference of 8.7 centimeters. If design specifications required a piece of equipment to "fit" 98% of the USA population with respect to stature it would have to accommodate men with heights between 160.8 and 187.2 centimeters. It may be noted from Table 1-35 that in order to find a Korean measure equal to the lower limit in the USA population one must approach the 25th percentile. Consequently, nearly 25% of the Korean military population fall below the lower limit and could not be expected to operate the equipment effectively. In this case, the upper limit is not a problem.

Under the same hypothetical conditions, the lower limit design specification for leg length would be 74.2 centimeters. About 40% of the Korean population fall below the lower limits. The lower limit for forearm-hand length would be 42.9 which means that 25% of the Korean soldiers have arms too short to "fit" the equipment. Again, the upper limit presents no problem inasmuch as the longest Korean arms do not exceed it.

TABLE 1-35. DIFFERENCES IN STATURE BETWEEN KOREAN TROOPS & U. S. TROOPS
(values in centimeters)

Percentiles	USA	Korean	Difference
1	159.3	153.7	5.6
2	160.8	155.1	5.7
5	163.3	156.7	6.6
10	165.6	158.8	6.8
25	169.7	161.8	7.9
50	174.0	165.3	8.7
75	178.3	168.4	9.9
90	182.4	171.6	10.8
95	184.4	173.0	11.4
98	187.2	175.2	12.0
99	189.2	176.4	12.8

TABLE 1-36. DIFFERENCES IN LEG LENGTH BETWEEN KOREAN TROOPS & U. S. TROOPS
(values in centimeters)

Percentiles	USA	Korean	Difference
1	73.2	65.7	7.5
2	74.2	67.3	6.9
5	76.2	68.6	7.6
10	77.7	70.2	7.5
25	80.5	72.5	8.0
50	83.3	75.1	8.2
75	86.4	77.5	8.9
90	89.2	79.6	9.6
95	90.9	80.9	10.0
98	92.7	83.6	9.1
99	94.5	87.4	7.1

TABLE 1-37. DIFFERENCES IN FOREARM-HAND LENGTH BETWEEN KOREAN TROOPS & U. S. TROOPS
(values in centimeters)

Percentiles	USA	Korean	Difference
1	42.4	34.8	7.6
2	42.9	39.9	3.0
5	43.9	41.1	2.8
10	44.7	41.9	2.8
25	46.0	43.0	3.0
50	47.5	44.1	3.4
75	49.0	45.3	3.7
90	50.3	46.2	4.1
95	51.1	46.7	4.4
98	52.1	47.5	4.7
99	52.6	47.9	4.7

An examination of these three measures and the differences between the two populations suggests a very real question concerning the efficacy of equipment interchange. It is quite clear that much of the USA equipment is not ideally fitted for use by rather large percentages of the Korean military population.

Substantiating the idea that simple equipment interchange between Korea and the United States probably has deleterious effects upon Korean performance are the results of the equipment evaluation survey. Korean soldiers reported they could operate equipment with smaller control-display configurations significantly easier than equipment with larger configurations.

2. Clothing

The overall range of stature among Korean military personnel (from 154 to 176 cm.) is 22 centimeters. If clothing is sized in three lengths, each length would be required to fit men with a range of about seven centimeters in height. With four lengths of clothing, the range of stature for each length would be reduced to 5.5 centimeters. An additional body measurement of use in considering the lengths of upper body clothing is back waist length, which is measured from the base of the neck to the waist level. The range of this measurement is 12.1 centimeters; thus each of three lengths would be required to fit a range of about four centimeters in back waist length.

The overall range of chest circumference among Korean military personnel (from 80 to 99 cm.) is 19 centimeters. Thus, with three girth sizes of upper body clothing, each size would be required to fit a range of 6.3 centimeters of chest girth. Neck circumference and sleeve length are used in the sizing of shirts. The range of neck circumference in this survey is 7.4 centimeters, and the range of sleeve length is 16.5 centimeters.

Waist circumference and crotch height are the two body measurements controlling the sizing of trousers. The overall range of waist circumference among Korean military personnel (from 66 to 86.5 cm.) is 20.5 centimeters. With three waist sizes of trousers, each size would be required to fit a range of about seven centimeters in waist girth. With four sizes, the waist girth range for each size would be reduced to five centimeters. The range of the crotch height is 21.7 centimeters. Therefore, each of three trouser inseam lengths would be required to fit a range of 7.2 centimeters in inseam.

The range of head circumference may be used for the sizing of head gear. Head circumference among Korean military personnel covers a range of 6.1 centimeters. Other measures to be considered for sizing head gear are head breadth, head length, and head height. The significance of these measures is recognized when the fact is considered that while the Korean head circumference mean is significantly smaller than the U. S. soldier's mean head circumference, the converse is true of head breadth.

The overall range of foot-length among Korean military personnel is 7.2 centimeters, and the range of foot breadth is 2.0 centimeters. In general, the Korean foot and hand are short and broad.

In conclusion, only a few of the human factors implications of the anthropometric survey of the Republic of Korea have been suggested. Equipment design, modification, and ultimate use will be affected by the information on body sizes of Korean military personnel only after research and development efforts over a several year period. A start has been made, however, and data on the range and variation in body size in the military population of Korea are now available for use.

SECTION II

DESCRIPTION OF THE STUDY

A. INTRODUCTION

Hardware development, originally intended to extend man's sensory or physical capabilities to assist him in his conquest of nature, has evolved into the construction of complex systems whose functions transcend original intents. Systems are conceived and developed in terms of their over-all missions rather than to merely extend one of man's senses. Hence, the human organism has come to be viewed as a complex component of man-machine systems; a component whose effectiveness must be evaluated in much the same manner as the hardware components; and a component whose performance may adversely affect the over-all performance of a system.

1. Fit and Performance

Human performance in a system is a function of many complex interactions, some of which have undoubtedly not yet been identified. One of these interactions has received both empirical and logical attention in the past two or three decades and has demonstrated a strong relationship to system performance. This interaction has come to be known as the man-machine interface, and includes such considerations as the fit of clothing, the work space of an operator, and the position, size, shape, and general configuration of controls and displays. Consequently, the work which is reported in this volume was performed on the assumption that system performance is a function of, among other things, performance of the human components; and that human performance is in part a function of the degree to which the equipment matches man's physical and psychological attributes.

One of the objectives of the military assistance program of the United States of America is to improve the military defense posture of our allies by supplying them with equipment and materials. An underlying assumption of such action is that in so doing we improve their position both quantitatively and qualitatively. Indeed, helping to supply a nation with enough arms and equipment to meet the needs of its defense situation seems basically sound, but to assume that the equipment improves the defense situation qualitatively is not quite so justifiable. The delicate balance of the man-machine interface might well be upset considerably in a situation where hardware is used by a population for which it was not designed. In other words, no matter how sophisticated the equipment or weaponry may be, if it is too heavy, light, long, short, or otherwise difficult to operate for the user population, it might decrease rather than improve system performance. Effective human engineering requires the use of data acquired from the specific population for which the equipment is intended. Consequently, the donor-recipient sizing discrepancy problem is the major consideration of this report.

2. Previous Anthropometric Studies in Korea

Two anthropometric studies of record have been conducted in Korea: in 1953 reported but not conducted by Newman and in 1961 conducted and reported by Kay. In the former, sixteen body measures were taken and the author listed several important reservations about the data submitted to his office for analysis. Dr. Kay's study, apparently conducted in a very careful, professional manner, was carried out on a highly select group of 264 ROK pilots, thus not permitting generalization to the total military population.

3. The Present Study

The present anthropometric survey, which is one of several recently sponsored by the U. S. Army Natick Laboratories, under the direction of Mr. Robert White, was conducted to collect data on the body dimensions of a large sample of the Korean military population to permit meaningful generalizations. The Korean data have been carefully compared with data collected from U. S. soldiers in an effort to identify body dimensions and/or proportions which appear to differ significantly. To assist in the identification of "significant" size differences, equipment evaluation data was collected from the entire sample. Analyses of these data have made it possible to define the range and variation of body size to be expected in the military personnel of the Republic of Korea, from which design criteria may be formulated.

In summary, the present Korean anthropometric study was conducted to accomplish the following:

1. Define the physical characteristics of the Korean military population.
2. Quantify differences in physical characteristics between military populations of Korea and United States.
3. Define the relationship between Korean acceptance of U. S. equipment and body size of Korean soldiers.
4. Examine for possible relationships between body sizes and performance.
5. Develop new anthropometric techniques which will permit the measurement of more subjects, in less time, with more accuracy.

B. RESEARCH DESIGN

While the primary purpose of this study was to collect anthropometric data on Korean soldiers, some rather important methodological problems were also investigated. For example, a data recording system was used which virtually eliminated human data handling between the initial data recording and the final computer printout. Also, a great deal of effort was expended to arrive at "the" optimal measuring procedures, permitting the greatest number of subjects to be measured most accurately in the least amount of time.

Needless to say, these methodological explorations necessitated a certain amount of debugging via a pilot study. The pilot study permitted a carefuly, systematic examination of the new data collection techniques prior to their use in the survey. This allowed a few critical changes to be made which resulted in a much more refined and sophisticated data collection system.

1. General Procedures

a. Planning

Initial planning for the anthropometric survey in Korea was accomplished through the joint efforts of the contractor and representatives of the sponsor at U. S. Army Natick Laboratories in Massachusetts. It was decided that a sample size of about 4,000 soldiers was desirable, and that a pilot study should precede the major data collection effort by a few months.

b. Pilot Study

During the month of May, 1965, two members of the research team traveled to Korea to conduct the pilot study. Three Korean interpreter-translators were hired to assist in all phases of the research. After the necessary liaison activities were performed and the interpreters had received sufficient

training the research team traveled to the measuring site, about 30 miles out of Seoul. Several days were spent training thirty ROK enlisted men in the art and science of measuring and recording the various body measures, after which approximately 200 Korean soldiers were measured. Each of the subjects went through the measurement procedures twice, once on each of two successive days. Hence the measurer-recorders performed 400 sets of measures.

In addition to the body measurements each subject was administered an equipment evaluation questionnaire, following which most of the respondents were interviewed by one of the interpreters in regard to the human-equipment interface.

c. Major Survey

During the latter portion of September 1965, the research team traveled to Korea to conduct the anthropometric survey. Upon arrival in Korea the two interpreters were re-hired and given additional training; measurers and recorders were trained at five different locations and 59 body measures, 19 demographic measures, and 20 equipment evaluation measures were collected from approximately 3400 army troops, 200 marines, 200 sailors, and 200 air force personnel. After five weeks of data collection activities the research team returned to the United States.

2. Methodological Considerations

In general, physical anthropologists have held the view that in anthropometric surveys, body measurements should preferably be taken by professional anthropologists. While in some cases (Hertzberg 1950) graduate students have been used under close supervision it has often been thought to be out of the question to use laymen. It has been argued that too much is lost with respect

to skill level and motivation when non-professionals are used as measurers. Consequently, most "large" surveys have been conducted by small numbers of professionals. This practice has imposed serious limitations upon data acquisition by virtue of the time involved and money required to do such surveys (Oshima 1965, Stoudt 1965). Most of the surveys in which the use of non-professional measurers has been attempted have failed to report the mechanics of such a procedure; furthermore, there has been but little critical self-evaluation of the efficacy of the procedure (Newman 1951, Morant 1947, Sahley 1957, Hooton 1959. A review of the literature suggests that surprisingly little attention is given to the methodological aspects of anthropometric surveys and yet it appears realistic to indicate that there seems to be some very serious problems yet unsolved. Just one of the 121 references in Hansen's (1958) "Annotated Bibliography of Applied Physical Anthropology in Human Engineering" deals specifically with methodology. Daniels (1953) trained enlisted men and women as measurers and recorders for his study of Air Force basic trainees and he went further than most in reporting the methodological aspects of his study. Although nothing was reported with respect to measurer skill level, the measurement procedures, team composition, and line flow were described in detail.

Generally speaking, too little concern has been given to the methodological aspects of anthropometric surveys, especially insofar as consistency and accuracy checks are concerned, at least, if it has been done, precious little has been reported about the conclusions. For example, can the following questions be answered adequately; is there a significant difference in accuracy between professional and non-professional measurers? What degree of measurement reliability is obtained when using professionals? When using non-professionals? When taking a variety of body measurements what are the effects

upon quality and quantity of measurement as regards teams who specialize in subgroups of measurements (production line), as opposed to conditions in which each measurer takes a subject through all of the measurements? How many measurements can be taken in what lengths of time under various measurement conditions? If it can be done at all, what amount of training is required for non-professionals to become competent measurers? Can indigenous personnel of a foreign culture and language be trained to take body measurements adequately? It is with this last question that the present study has been concerned.

White (1964) conducted rather extensive anthropometric surveys in Thailand and Vietnam using non-professional measurers. His evaluation of the feasibility of using members of the indigenous population as measurers was stated thusly:

> "A significant aspect in planning the anthropometric survey of Thailand was the provision that all of the measuring would be carried out by the Thai personnel who would be trained and supervised by a qualified anthropologist. This procedure proved to be entirely satisfactory..."

White reports the same results with his survey in Vietnam. While White's work appears to answer the above question in the affirmative, there remains a need for a more objective report as to what "entirely satisfactory" means. For the research reported herein, the investigator's subjective evaluation resulting from observation was supplemented with a more objective assessment procedure. A test-retest design was incorporated into the measuring scheme in order to assess measurement reliability. Methodological exploration was confined to the Pilot Study of this project while the major data collection phase incorporated some of the findings. Consequently, methodological considerations are discussed largely under the Pilot Study heading.

a. Pilot Study

The survey was conducted in South Korea, in June of 1965. One hundred eighty-six Korean infantry soldiers were measured, 97 of whom were members of the Republic of Korea Army, and 89 who were members of the Korean Augmentation of the U. S. Army. The majority of these men were privates or pfc's, about 22 years of age, had been in the military service for less than one year, and had been born and raised in the province of Choong-Chung.

1) Measurements & Equipment: Fifty-nine body measurements were taken (see Section I) which included dimensions of all parts of the body: weight, skin-folds, body lengths, breadths, and circumferences, together with selected measurements of the head, face, hands, and feet. Standard anthropometric equipment (calipers, slides, scales, etc.) were used for all measurements.

All body measures were taken (recorded) in the metric system and were read to the nearest millimeter. Weight was recorded to the nearest kilogram. As a measurement was taken it was called out to the recorder and as the recorder transcribed the number he would call it back to the measurer. Specially prepared optical scan data processing cards were used for data recording. Each of the measures was labelled in Korean and in English. Below each of the names of body measures were from two to four columns of boxes numbered from zero through nine. This arrangement permitted the measurements to be recorded merely by marking the appropriate boxes. The data derived therefrom was placed on tape which was then processed in the computer.

2) Measuring Stations: The fifty-nine measures were grouped into six measuring stations on the basis of type and location of measurements, and the particular instrument(s) which would be involved. A team of one measurer and one recorder

was located at each station. During the initial stages of the survey, several changes in grouping were necessary in order to eliminate "bottlenecks" and facilitate an even flow of subjects from station to station. Once an even flow was established subjects egressed from the system at a rate of one every three minutes.

3) Training Procedures: Thirty-three enlisted men from the ROK infantry were trained as measurers and recorders. They were given an orientation in which the purpose of the study was explained, the anthropometric instruments were displayed, and all of the 59 body measures were demonstrated. Data recording booklets were distributed to all of the men, after which they were instructed in all of the particulars of marking the cards.

Upon completion of the orientation period the group was broken into teams composed of one man to measure and one to record. Each team was carefully and systematically trained to perform all of the measurements of the station to which it was assigned. The investigator described and demonstrated the appropriate measurements (via interpreters) to each measurer at his respective station. Each measurer then demonstrated the measurements to the investigator, followed by corrections and/or suggestions when necessary. The measurers then practiced on one another for the remainder of the day under supervision.

On the third day of training the measuring lines were formed and one subject went through each line. Each of the measurers performed the measurements for which he was responsible, and the measurements were recorded. At the conclusion a member of the research team performed the 59 measurements on the subjects. These measurements compared favorably with those of the measurers insofar as differences rarely exceeded one centimeter. At this point, a group

of 15 subjects were run through the line several times. Careful observation of this phase of the training program resulted in the decision to proceed with the experiment of using non-professionals to perform the measurements.

4) Test-Retest: One hundred eighty-six Korean soldiers were measured in groups of slightly less than 50 each. Each man was measured twice, at the same hour of each of two successive days. Their data collection cards were coded to permit the comparison of both sets of measurements for each subject. Pearson Product Moment correlations were computed for each of the 59 measurements using first and second measures on each subject as the variables.

5) Results: The mean of 59 reliability coefficients is .84. Table 2-1 contains reliability coefficients for each of the 59 measures and the means of coefficients for each of the groups of measures. Weight, height, and shoulder height yielded the highest coefficients with .98, .99, and .99 respectively. Breadth and depth measures, as well as sitting heights and extremity lengths have mean coefficients in the low .80's. Circumferences and the smaller head, face, and foot measurements ranged in the high and middle .70's. The lowest coefficients of the entire 59 measures, .35 and .37, were for inter-pupillary distance and instep length respectively.

6) Discussion: The coefficients ranged from .35 for inter-pupillary distance, to .99 for stature. The wide range of coefficients, together with the grouping of homogeneous measures, reflect the variability of measurement difficulty. The issue at hand, however, is not to determine which of the measurements are most difficult to perform but instead, to determine whether anthropologically naive enlisted men in the Korean Army are capable of adequately performing as measurers in an anthropometric survey.

While .84 would not be considered an appropriately high reliability coefficient in some situations, in others it would be highly regarded. In the present instance it would seem to be very acceptable. First of all there are a large number of variables which have to be carefully controlled at the instant of measurement, such as the breathing, posture, position, and tenseness of the subject. These are not easily controlled and indeed, in some cases, not even possible to fully control, as to permit identical conditions under each of the two measurement situations. Second, many of the measurements have very difficult, evasive measuring locations which require considerable subjectivity on the part of the measurer. Next, only a couple of the measurements had extremely low coefficients of correlation and yet the mean of the coefficients is affected disproportionately. For example, if the interpupillary distance data was deleted from the computations it would raise the mean of the head and face measures from .76 to .84. Similarly, if the data for instep length were deleted the mean of the foot measures will climb from .78 to .92.

TABLE 2-1. TEST-RESTEST RELIABILITY COEFFICIENTS FOR PILOT STUDY SAMPLE

Weight		.98
Skin folds		.85
Juxta nipple	.74	
Mid-axillary	.84	
Sub-scapular	.93	
Triceps	.90	
Standing heights		.93
Stature	.99	
Shoulder	.99	
Waist	.86	
Crotch	.97	
Knee cap	.81	

TABLE 2-1. TEST-RETEST RELIABILITY COEFFICIENTS FOR PILOT STUDY SAMPLE - Continued

Sitting heights		.82
Arm reach upward	.95	
Total height	.80	
Eye	.72	
Shoulder	.88	
Knee	.77	
Popliteal	.83	
Breadths and depths		.82
Chest depth	.91	
Chest breadth	.50	
Hip breadth (standing)	.81	
Shoulder breadth	.96	
Elbow to elbow	.90	
Hip breadth (standing)	.86	
Arm, leg, and torso lengths		.81
Arm reach forward	.86	
Shoulder-elbow	.94	
Forearm-hand	.99	
Buttock-knee	.87	
Buttock-popliteal	.84	
Sleeve inseam	.47	
Back-waist	.68	
Sleeve length	.85	
Circumferences		.76
Crotch-thigh	.92	
Lower thigh	.81	
Calf	.80	
Ankle	--	
Heel-ankle diagonal	.72	
Ball foot	.63	
Head	.96	
Neck	.45	
Shoulder	.85	
Chest	.70	
Waist	.87	
Hip	.71	
Upper arm	.82	
Wrist	.53	
Hand	.92	

TABLE 2-1. TEST-RETEST RELIABILITY COEFFICIENTS FOR PILOT STUDY SAMPLE - Continued

Head and face		.76
Head height	.69	
Inter-pupillary	.35	
Face length	.78	
Face breadth	.89	
Head breadth	.94	
Head length	.93	
Foot		.78
Length	.91	
Instep length	.37	
Foot breadth	.89	
Heel breadth	.97	
Hand		---
Mean reliability coefficient	.84	

Note: Data processing difficulties prevented the calculation of correlation coefficients for ankle circumference and hand measures.

In conclusion, the statistical results and analysis of the test-retest data are interpreted as supporting the notion that Korean enlisted men are capable of performing adequate measurements in an anthropometric study. The investigator's observations in the field, during the training phase, and the actual measurement phase also support this notion.

The measurement procedures contemplated for use in the main survey were deemed adequate and incorporated into the research design.

b. Main Survey

1) Measurements and Equipment: Fifty-nine body measurements were selected which include dimensions of all parts of the body: weight, skinfolds, body lengths, breadths and circumferences, together with selected measurements of the head and face and the hands and feet. These measurements may be classified into two

categories. Some of the measurements are those whose primary use is in the design, sizing, and grading of clothing, while others are of importance in the design and sizing of military equipment from the standpoint of human engineering.

While "standard" anthropometric measuring devices were used to perform "standard" body measures there was very little else in the procedure which could be classified as "standard." There was, in fact, a deliberate attempt to depart from the conventional way of doing things in an effort to improve upon the state of the art. Especially was this true of the physical configurations of the lines of men being measured, and also with the way in which the data was recorded.

2) Measuring Stations: For the pilot study the 59 measures were grouped into six measuring stations. Grouping was accomplished on the basis of type and location of measurements, and the particular instrument(s) which were involved. The measurements were grouped so as to permit the maximum number of accurate measurements in the least amount of time, and using the least number of instruments per station. For the most part, only one instrument was required at each measuring station, which 1) reduced the total number of instruments required, 2) eliminated the time required for a measurer to change instruments, and 3) reduced the training time required. Table 2-2 illustrates the organization of measurements by station.

TABLE 2-2. ANTHROPOMETRIC MEASURING SCHEME

Station #1 - Scales and Skinfold Caliper

1. Weight
2. Juxta nipple
3. Mid-axillary
4. Sub-scapular
5. Triceps

Station #2 - Anthropometer

6. Standing height
7. Shoulder height
8. Waist height
9. Crotch height
10. Kneecap height
11. Arm reach upward (sitting)

Station #3 - Anthropometer

12. Sitting height
13. Eye height
14. Shoulder height
15. Knee height
16. Popliteal height

Station #4 - Large Sliding Caliper

A. Standing

17. Chest depth
18. Chest breadth
19. Hip breadth

B. Sitting

20. Arm reach forward
21. Buttock - knee length
22. Buttock - popliteal length

Station #5 - Large Sliding Caliper

23. Shoulder breadth, sitting
24. Elbow-to-elbow breadth, sitting
25. Hip breadth, sitting
26. Head height
27. Shoulder-elbow length
28. Forearm-hand length

TABLE 2-2. ANTHROPOMETRIC MEASURING SCHEME - Continued

Station #6 - Footbox, Steel Tape

29. Foot length
30. Instep length
31. Foot breadth
32. Crotch-thigh circumference
33. Lower thigh circumference
34. Calf circumference
35. Ankle circumference
36. Heel-ankle diagonal
37. Ball-foot circumference
38. Head circumference
39. Neck circumference

Station #7 Steel Tape

40. Shoulder circumference
41. Chest circumference
42. Waist circumference
43. Hip circumference
44. Upper arm circumference
45. Wrist circumference
46. Hand circumference
47. Sleeve inseam
48. Interscye breadth
49. Back-waist length
50. Sleeve length

Station #8 - Small Sliding Caliper, Small Spreading Caliper

51. Hand length
52. Palm length
53. Hand breadth
54. Interpupillary distance
55. Facial length (height)
56. Face Breadth
57. Head breadth
58. Head length
59. Heel breadth

Station #9 - Demographic Data

During the pilot study, line flow was carefully and systematically studied. It was observed that several changes were necessary in order to eliminate piling up at some of the stations. It can be noted in Table 2-3 that stations 2 and 6 were the worst bottlenecks. Also, the data indicates that as

the measurers gained more experience the measurement time became less and waiting time increased. This reciprocal arrangement appears to be a function of the rate at which subjects were fed into the measuring line and would suggest that if the measuring stations were arranged in descending order with respect to measuring time required, that it would virtually eliminate waiting time in the lines. Another interesting observation is that while considerable improvement is demonstrated between the beginning of the session and the mid-point, very little change occurred between the mid-point and the end. Finally, the optimal configuration was found to consist of nine stations, the last of which was used for collecting demographic data. It became apparent that stations 1 and 9 could handle twice as many subjects as any of the other stations. The measuring configuration that evolved consisted of 4 measuring lines running simultaneously. This arrangement matched perfectly with the barracks accommodations provided as a measuring site. Two separate lines were run down a wing of a barracks. Both lines had their own stations 2-8, but shared stations 1 and 9 in common. Thus, there would be four each of stations 2-8 and two duplicates of stations 1 and 9. This set up was so efficient that it was able to put measurees through at a sustained average rate of 135 men per hour.

Peak measuring day on the site was 800 men in about 6 hours and was limited simply by availability of subjects, not by system capacity. Parenthetically, it should be noted that there were other data collection efforts underway too, which also consumed time (questionnaire, some interviewing, etc.). It should be readily possible to make collection of anthropometric data on the 59 measures used here from 1000 men in one 8 hour day under supervision of one professional.

TABLE 2-3. ANTHROPOMETRIC FLOW ANALYSIS: MEAN WAITING & MEASURING TIMES FOR STATION, SUBJECT, & TOTAL GROUP

Subject		Station 1: 5 Measures Wt. & Skfd. (N=8)	Station 2: 11 Measures Hts. (N=8)	Station 3: 6 Measures Brs. & Lts. (N=7)	Station 4: 6 Measures Brs. & Lts. (N=7)	Station 5: 10 Measures Foot & Leg (N=8)	Station 6: 13 Measures Head, Body circ. (N=8)	Station 7: 8 Measures Head, Face (N=8)	Total Stations
5th	W		3:53	0:45	0:45	0:42	1:45	1:11	9:01
	M	2:02	4:38	2:46	2:01	2:53	3:13	2:00	19:33
	T	2:02	8:31	3:31	2:46	3:35	4:58	3:11	28:34
17th	W		2:01	1:34	1:34	1:07	2:07	1:01	9:24
	M	1:39	3:31	2:17	1:57	2:25	3:13	2:13	17:15
	T	1:39	5:32	3:51	3:31	3:32	5:20	3:14	26:39
37th	W		3:45	1:12	1:12	1:07	2:14	0:39	10:09
	M	1:41	3:07	2:10	1:47	2:23	3:11	1:43	16:02
	T	1:41	6:52	3:22	2:59	3:30	5:25	2:22	26:11
		(N=24)	(N=24)	(N=21)	(N=21)	(N=24)	(N=24)	(N=24)	
Total Group	W		3:13	1:10	1:10	0:59	2:02	0:57	9:31
	M	1:47	3:45	2:24	1:55	2:34	3:12	1:59	17:36
	T	1:47	6:58	3:34	3:05	3:33	5:14	2:56	27:07

W Waiting Time M Measuring Time T Total Time

Note: Eight groups of fifty were measured. The 5th, 17th, and 37th subjects to enter the line from each group were selected for the above observations.

Table 2-2 illustrates the measuring line composition used during the major portion of the anthropometric survey. This configuration still presented some "piling up" problems at stations involved with the measurement of circumferences until the "floating team" concept was instituted. Under the "floating team" concept two extra men were trained to take all of the circumference measures so that they could move from line to line and station to station as the demand arose. Implementation of the "floating team" eliminated the "piling up" problem.

3) Training Procedures: The training procedures incorporated for the main anthropometric survey were essentially the same as those used during the pilot study with one or two exceptions. It was demonstrated in the Pilot Study that some measurements required more detailed and more intensive training than others, and total training time was reduced to one and two days. Satisfactory performance was obtained when the measurers were trained intensively for one day, and then carefully supervised during the first day of measurements. Throughout the course of the anthropometric survey at least one professional and two interpreters patrolled the measuring lines constantly in order to be absolutely certain that the measurers were maintaining proper quality control all through the measuring session. As matters turned out, the measurers had extraordinarily high spirit and were almost compulsively assiduous in their effort to do well so there was little need for attention. The experimenters have often had occasion to wish USA troops would be even half as intelligent and motivated to help in a study!

4) Recording Techniques: Each measuring station consisted of a measurer and a recorder. As a measurement was taken it was called out to the recorder, as the

recorder transcribed the number he called it back to the measurer. Specially prepared optical scan data processing cards were used for data recording. Every subject was given a booklet of cards which he presented to the recorder at each station.

To minimize the language difficulties for both recorders and data processors each body measure and demographic category was labelled in Korean and English. Below each demographic category was a list of the possible responses with an empty box adjacent to each. Below each of the names of body measures there were from two to four columns of boxed numbered from zero through nine. Such an arrangement permitted the recorder to indicate to the nearest millimeter the measure called out by the measurer by placing X's in the appropriate boxes. The completed cards were shipped to the United States where they were run through an optical scanner which automatically punched the cards which were then fed to the computer. This semi-automated data collection procedure greatly reduced the probability of error due to handwriting, translation, and card punch operations. The economics of a procedure of this nature are obvious: the measuring team can work a good deal faster with a greatly reduced probability for error.

5) Description of Measurements and Techniques: Eight measuring devices were used in this study. They are listed below and referred to by letter in the description of each measurement.

A. Anthropometer
B. Foot box
C. Large sliding calipers
D. Small sliding calipers
E. Skinfold calipers
F. Spreading calipers
G. Spring scale
H. Steel tape

The following measurements were made while the man was standing erect with both feet on the floor.

1. (A) Standing height: Measurement was from the floor to the top of the head.

2. (A) Shoulder height: Measurement was from the floor to the outer point of the right shoulder (acromiale).

3. (A) Waist height: Measurement was from the floor to the top of the right hip bone (superior margin of ilium).

4. (A) Crotch height: Measurement was from the floor to the mid-point of the crotch, with anthropometer in firm contact with the skin.

5. (A) Kneecap height: Measurement was from the floor to the top of the right kneecap (patella).

6. (C) Chest depth: With the caliper held horizontally on the man's right side at the level of the nipples, measurement was made of the depth of the chest during normal (quiet) breathing.

7. (C) Chest breadth: With the caliper held horizontally at the level of the nipples, measurement was made of horizontal breadth of the chest with light skin contact during normal (quiet) breathing.

8. (C) Hip breadth, standing: With the caliper held horizontally, measurement was made of the widest breadth across the hips.

For the following measurements the man was sitting on a bench with his feet on blocks so that his knees were at right angles.

9. (A) Sitting height: Measurement was made from the bench to the top of head with the anthropometer firmly touching the scalp.

10. (A) Eye height, sitting: Measurement was made from the bench to the level of the inner corner of the right eye (inner canthus).

11. (A) Shoulder height, sitting: Measurement was made from the bench to the outer point of the right shoulder (acromiale).

12. (C) Shoulder-elbow length: With the man's right upper arm hanging at his side and his forearm extended horizontaly , measurement was made of the vertical distance from the outer point of the shoulder (acromiale) to the elbow (olecranon process).

13. (C) Forearm-hand length: With the man's upper arm hanging at his side and his forearm and hand extended horizontally, measurement was made of the horizontal distance from the tip of the right elbow (olecranon process) to the tip of the middle finger (dactylion) of the extended hand.

14. (C) Buttock-knee length: Measurement was made of the horizontal distance from the rear-most point of the right buttock to the front of the right kneecap.

15. (C) Buttock-popliteal length: Measurement was made of the horizontal distance from the rear-most point of the right buttock to the back of the righ knee (lateral head of gastrocnemius).

16. (A) Knee height, sitting: Measurement was made from the foot rest to the top of the right knee (not to the kneecap), with the blocks of the foot rest adjusted when necessary to keep the knees at right angles.

17. (A) Popliteal height: Measurement was made from the foot rest to the underside of the right knee (underside of the right tendon of the biceps femoris where it joins the calf), with the foot rest adjusted when necessary to keep the knees at right angles.

18. (C) Shoulder breadth, sitting: With the man's upper arms hanging at his sides, measurement was made of the maximum breadth across the shoulders, including the upper arm muscles of both arms.

19. (C) Elbow-to-elbow breadth: With the man's upper arms hanging at his sides and his forearms extended horizontally, measurement was made of the maximum breadth across the lateral surfaces of the elbows.

20. (C) Hip breadth, sitting: Measurement was made across the widest breadth of the hips.

21. (A) Arm reach upward: With the man's right arm extended straight above his shoulder, measurement was made from the bench to the tip of the middle finger (dactylion) in his extended hand.

22. (C) Arm reach forward: With the man's right arm extended horizontally in front of him, measurement was made of the horizontal distance from the back of the shoulder (greatest bulge of trapezius) to the tip of the middle finger (dactylion) of his extended hand.

The following measurements were made with the man standing erect on a bench with his weight evenly distributed on both feet.

23. (H) Neck circumference: The circumference of the neck was measured with the tape passing just below the "adam's apple" (thyroid cartilage).

24. (H) Shoulder circumference: The maximum circumference of the shoulders was measured with the tape passing over the greatest lateral protrusion (bulging) of the deltoid muscles of both arms.

25. (H) Chest circumference: With the man's arms raised, the tape was placed in position around the chest, then with the arms lowered, measurement was made of the circumference of the chest at the level of the nipples, during normal (quiet) breathing.

26. (H) Waist circumference: Measurement was made of the circumference of the waist at the level of the umbilicus, with the abdomen relaxed.

27. (H) Hip circumference: Measurement was made of the maximum circumference of the hips at the level of the greatest rearward protrusion of the buttocks.

28. (H) Upper arm circumference: With the right arm relaxed, measurement was made of the circumference of the upper arm at the level of the biceps muscle, midway between the shoulder and elbow.

29. (H) Wrist circumference: Measurement was made of the minimum circumference of the right wrist above the protrusion of the wrist bone.

30. (H) Crotch-thigh circumference: Measurement was made of the circumference of the right upper thigh in a horizontal plane just below the lowest point of the gluteal furrow.

31. (H) Lower-thigh circumference: Measurement was made of the circumference of the right lower thigh in a horizontal plane just above the right kneecap.

32. (H) Calf circumference: Measurement was made of the maximum circumference of the right calf in a horizontal plane.

33. (H) Ankle circumference: Measurement was made of the minimum circumference of the right ankle just above the projections of the ankle bones (malleoli) in a horizontal plane.

34. (H) Back waist length: Measurement was made of the length along the back from the base of the neck (cervical) to the waist (level of the iliac crest).

35. (H) Interscye breadth: Measurement was made of the distance across the back between the creases of the armpits.

36. (H) Sleeve inseam: With the man's right arm extended and held away from the body, measurement was made of the length from the front edge of the armpit along the arm to the notch between the thumb and the wrist.

37. (H) Sleeve length: (spine-to-wrist) with the man's arms held horizontally, his elbows bent at about right angles, and his fists pressed together, measurement was made of the distance from the middle of the back (spinal crease), the tape passing over the right elbow, to the wrist (middle of the styloid process).

The following measurements were taken while the man was sitting on a bench.

38. (F) Head length: Measurement was made of the maximum length of the head from the forehead (slightly above the eyes) to the back of the head.

39. (C) Head height: Measurement was made of the vertical distance from the notch in front of the right ear (tragion) to the top of the head (vertex) with firm pressure on the scalp.

40. (D) Face length: Measurement was made of the length of the face from the nasal root depression (between the eyes) to the tip of the chin.

41. (F) Head breadth: Measurement was made of the maximum breadth of the head, usually found above and behind the ears.

42. (H) Head circumference: Measurement was made of the maximum circumference of the head, the tape passing above (but not including) the ridges over the eyes and just above both ears.

43. (D) Interpupillary distance: With the man looking at a point between the measurer's eyebrows, measurement was made of the distance between the centers of the pupils.

44. (F) Face breadth: Measurement was made of the maximum breadth of the face across the most laterally projecting bone of the cheek.

45. (D) Hand length: With the man's right hand extended, the palm up and the fingers straight, measurement was made of the length of the hand from the wrist to the tip of the middle finger.

46. (D) Palm length: With the man's right hand extended, the palm up and the fingers straight, measurement was made of the length of the palm from the wrist to the base of the middle finger.

47. (D) Hand breadth: With the man's right hand extended, the palm up and the fingers straight, measurement was made of the maximum breadth of the hand across the base of the fingers.

48. (H) Hand circumference: With the thumb held away from the hand, measurement was made of the circumference of the right hand at the level of the base of the fingers (metacarpal-phalangeal joints).

The following measurements were made with the man standing on a bench with his weight evenly distributed on both feet.

49. (B) Foot length: With the man's right foot in the foot box, measurement was made of the maximum length of the foot from the heel to the tip of the longest toe.

50. (B) Instep length: With the man's right foot in the foot box, measurement was made of the length of the right foot from the heel to the widest part of the foot (ball of the foot).

51. (B) Foot breadth: With the man's right foot in the foot box, measurement was made of the maximum breadth of the foot at the ball of the foot.

52. (H) Ball-foot circumference: Measurement was made of the maximum circumference of the right foot at the ball of the foot.

53. (D) Heel breadth: Measurement was made of the maximum breadth of the right heel behind and below the projections of the ankle bones (malleoli).

54. (H) Heel-ankle diagonal: Measurement was made of the diagonal circumference around the right ankle, the tape passing under the tip of the heel and over the instep at the junction of the foot and the leg.

55. (G) Weight: Each man was weighed and his weight recorded to the nearest kilogram.

56. (E) Juxta nipple: Measurement was made of the thickness of the skin and subcutaneous tissue on the right side of the chest just adjacent (above and lateral) to the nipple, but not including any glandular tissue, to the nearest half-millimeter.

57. (E) Sub-scapular: Measurement was made of the thickness of the skin and subcutaneous tissue on the back just below the right scapula following the natural fold of the skin, to the nearest half-millimeter.

58. (E) Mid-axillary: Measurement was made of the thickness of the skin and subcutaneous tissue on the right side at the level of the ziphoid in the mid-axillary line (MAL-X), to the nearest half millimeter.

59. (E) Triceps: With the man's right arm hanging straight and relaxed measurement was made of the skin and subcutaneous tissue on the back of the right upper arm midway between the shoulder (tip of acromion) and the elbow (tip of olecranon), to the nearest half millimeter. The midpoint was determined with the arm in 90^{o} flexion.

6) Criterion Considerations: Knowing the weight, height, breadth, and depth of the "average" Korean soldier is essential to the development of accurate sizing criteria from which clothing and equipment may be manufactured. However, in order to determine the areas in which our present sizing criteria are inadequate, and to assess the seriousness of those inadequacies, additional data is desirable. Two kinds of data have been assimilated into the evaluation system: anthropometric data of U. S. soldiers, and equipment evaluation by ROKA troops. Performance measures of ROKA troops would serve as the strongest criterion measure.

ROKA/USA Anthropometric Comparisons

One of the most obvious ways to identify potential sizing problem areas is to compare Korean body measurements with body measurements of the USA population. The major assumption of this approach is that the present design and sizing criteria utilized by the United States are functions of the information derived from the USA anthropometric data. In other words, the USA anthropometric data is assumed to represent the current design and sizing standards. When and if significant differences are demonstrated between ROKA and USA anthropometric data, their location and magnitude will dictate the kinds of design and sizing changes required for the production of equipment to be used by ROK personnel. The American data obtained for this comparison was taken from Hansen's annotated bibliography (1958).

Equipment Evaluation

Another approach to the identification of design and sizing problem areas is to acquire evaluations of the equipment from the users. In this case the major assumption is that equipment which has not been properly human engineered will result in safety hazards, inefficiency, and/or discomfort to the users, which will be reflected in their attitudes toward the equipment and will finally result in performance degradation.

Equipment was identified which was considered unsatisfactory to the users, as were the equipment characteristics which contribute to these opinions. This data was systematically compared to the ROKA/USA anthropometric comparisons in an effort to find those sizing and design discrepancies large enough to have negative casual effects. Testing the notion that significantly large sizing discrepancies are reflected in user attitudes is accomplished by analyzing the

attitudes (equipment evaluations) in terms of the body measures of the respondents. In other words, it was expected that the larger the discrepancy between the body measures of the user population and the population for which the equipment was designed, the more negative would be their equipment evaluations. Equipment evaluations not directly related to body size would of necessity be attributed to social and cultural factors not considered in the study reported herein. For a detailed treatment of the procedures, assumptions, and hypotheses of the equipment evaluation portion of this study, see the Appendix.

Performance

Attitudinal/body measure relationships must be considered inferential in that the former is only assumed to represent overt, physical behavior. Actual performance measures eliminate the inferential notion of attitudes and permit a direct examination of the effects of body size upon performance. However, performance measures are generally very complex and expensive and as a matter of expediency in most cases they are not seriously attempted. In the present instance both time and finances were inadequate to permit these elaborate performance studies.

SECTION I
SUMMARY

As a continuation of the work accomplished in Vietnam and Thailand by Robert M. White of U. S. Army Natick Laboratories, anthropometric and equipment evaluation surveys of the military personnel of the Republic of Korea were conducted between May and November of 1965. Body measurements and equipment evaluation data were obtained on a series of 3747 men (3249 army, 190 air force, 141 navy, and 167 marine). Fifty-nine body measurement and twenty equipment evaluation measures were made on each individual. In the course of this project procedures and supporting equipment were developed which permitted the collection of more data with greater accuracy in less time and with greater statistical interpretability than in any other anthropometric survey of record.

Of the 59 body measurements taken from Korean soldiers, 39 were directly comparable with data which had been previously collected from U. S. troops. The differences between means of the two samples were statistically significant on 30 of the measures. The means of data from U. S. troops exceeded those of Korean soldiers on 33 of the measures indicating larger physical size in almost all dimensions.

Korean troops expressed themselves on the question: "Insofar as 'fit' is concerned, the [equipment] supplied by the U. S. Army is ....." on a seven-point continuum ranging from "excellent" to "very poor." Respondents filled out a questionnaire containing general statements described above as well as more specific items relating to grasping, reaching, and positioning the equipment insofar as comfort and effectiveness were concerned. The Korean subjects rated the smaller, lighter equipment favorably with respect to ease of handling, and they reported considerable difficulty using larger weapons and equipment.

It has been conclusively demonstrated that Korean military personnel differ significantly in body dimensions from U. S. military personnel. It is equally clear that the Korean military population has shown a strong preference for those items of equipment which are more compatible with their body sizes. It should be clearly apparent that this finding has substantial implication for design, logistics, training, utilization, and other areas of consideration whenever equipment exchange between allies is under consideration.

A serious question has been raised by this research regarding the whole problem of equipment interchange between military allies who have substantially different physical characteristics from the group for which a given design was originally prepared.

Preliminary data suggests that there may, in fact, be a significant, quantitatively measurable change in military performance (number of hits, number of wrecks, abandonment of gear, etc.,) as a direct function of incompatibility between physical sizes of users and the equipment supplied by their allies. The strong likelihood that this is the case suggests an acute need for the further examination of the relationship between body size and human performance on various items of military equipment.

SECTION XV
ACKNOWLEDGMENTS

The research was planned and supervised by scientists from the United States of America who were financially supported by the United States Army through Natick Laboratories, but the collection of data was performed entirely by Republic of Korea personnel. Many individuals, therefore, contributed to the success of the anthropometric survey in Korea.

The technical monitor, Mr. Robert M. White, provided initial and continuous counsel from his broad and diversified anthropological surveys which proved invaluable at every turn of the project. Lt. Col. Paul N. Casper and his successor, Lt. Col. Monroe D. King, and the entire staff of the Human Factors and Operations Research Unit in Seoul, Korea provided the necessary preparations and logistic support without which the survey could not have been conducted. The liaison and scheduling so ably done by Mr. Hul Sok Cho was of such a nature as to permit the survey to be completed in a much shorter time than was anticipated. The ever-ready support and backing of Major General Chunkwon Chang and his staff at DCSPER ROKA was evident throughout the survey and is most gratefully acknowledged. Special appreciation is extended to Lt. Col. Hyohyon Lee, Chief of the Special Study Section, the System Study Group, ROKA HQ, who traveled into the field with the research team and provided resourceful "on the spot" assistance. Lt. Col. Chong Hwan Kim, Manpower Bureau (Military Affairs Bureau) of the Ministry of National Defense, met the requests of the research team with obvious insight during the entire survey.

The anthropometric survey in Korea could not have been possible without the understanding and cooperation of the many military commanders and their staffs who made available facilities at their installation and personnel under

their command. The facilities, which were such that the rapid-flow measuring scheme could be instituted, and the ready cooperation and discipline of the troops combined to permit more men to be surveyed in less time than in any previously recorded anthropometric study. The efficiency and assistance of the following officers is thus gratefully acknowledged: Brig. General Yong Hong Chong, Commander; Lt. Col. Sai Hwan Oh, G-1; and Captain Soo Hong Ahn, all of the 2nd ROKA Division; Brig. General Jun Hak Lee, Commander; and Major Jai Chol Lee, Assistant G-1, both of the 27th ROKA Infantry Division; Lt. Jai Poong Lee, of the Office of the Surgeon General; and Captain Yak Chon Lee, Chief of the Aerial Medical Research Center, both of the ROK Air Force; and 1st Lt. Kai Hyon Kim of the Office of the Surgeon General of the ROK Navy HQ.

Appreciative acknowledgment is made of the truly outstanding performance of the Republic of Korea military personnel who worked on the measuring teams. The army, navy, marines, and air force all provided enlisted men to train and work as measurers. In the United States this task is most commonly handled by professionally trained anthropologists, yet those men assigned to our study quickly and eagerly learned the techniques. They spent many hours in making exacting and tedious measurements. Observation by the research team revealed these men were operating with imagination, consistency, efficiency, and dispatch, reflecting great credit on the calibre of the Korean military units in particular and the nation in general.

Finally, whatever benefits may be derived from the study, and we think many will, a major portion of the credit must be given to two dedicated young men: Mr. Chikyong Kim and Mr. Kun-Hong Park, who served indefatigably as interpreters, translators, supervisors, instructors, questionnaire administrators,

and drivers during both the pilot study and major survey. These men worked long, hard hours with no complaints, and demonstrated considerable skill and personal initiative in many, many special ways.

SECTION V

REFERENCES

Atkins, E.L. Utilization of indigenous manpower in Korea. Operations Research Office, Johns Hopkins University, March 1961. ATI No. 135 769.

Brozek, J. Body measurements, including skinfold thickness, as indicators of body composition. In Techniques for measuring body composition, Josef Brozek and Austin Henschel (eds). National Academy of Sciences - National Research Council, 1961, pp. 3-35.

Daniels, G. S. and C. H. Meyers. Anthropometry of WAF basic trainees. Wright Air Development Center, WADC Technical Report 53-12, July 1953.

Daniels, G. S. and C. H. Meyers. Anthropometry of male basic trainees. Wright Air Development Center, WADC Technical Report 53-49, July 1953.

Domey, R. G., et al. Taxonomics and correlates of physique. Psychological Bulletin, 1964, Vol. 62, No. 6, pp. 411-427.

Fink, R. Interviewer training and supervision in a survey of Laos. International Social Science Journal, 1963, Vol. XV, No. 1, pp. 21-34.

Girard, A. Introduction. International Social Science Journal, 1963, Vol. XV, No. 1, pp. 7-20.

Hansen, R., and D. Y. Cornog. Annotated bibliography of applied physical anthropology in human engineering. Wright Air Development Center, WADC Technical Report 56-30, May 1958. AD 155-622.

Hart, G. L., et al. Attitudes of troops in the tropics. Rowland & Company, Inc., Haddonfield, N.J., 1964. AD 609-122/3/4.

Hertzberg, H. T. E., et al. Anthropometry of flying personnel - 1950. Wright Air Development Center, WADC Technical Report 52-321, 1954.

Hertzberg, H. T. E., et al. Anthropometric survey of Turkey, Greece, and Italy. MacMillan Co., 1963.

Hooton, E. A. Body build in a sample of the United States Army. U. S. Army Natick Laboratories, Technical Report EP-102, 1959.

Jones, E. L. The courtesy bias in South East Asian surveys. International Social Science Journal, 1963, Vol. XV, No. 1.

Kahn, L. A., et al. A study of North Korean and Chinese soldiers' attitudes toward the Korean war. U. S. Army Far East, Technical Memorandum ORO-T-34, 1955. AD 26 887.

Kay, W. C. Anthropometry of the ROKAF pilots. ROKAF Journal of Aviation Medicine, 1961.

McCune, S. Korea's heritage, a regional and social geography. Charles E. Tuttle Co., Rutland, Vt., 1961.

Morant, G. M. Anthropometric problems in the Royal Air Force. British Medical Bulletin, Vol. 5, No. 1, 1947.

Newman, R. W. Changes in body dimensions during basic training in relation to clothing sizes. Office of the Quartermaster General, 1951. AD 148 845.

Newman, R. W. Clothing size requirements for Korean military personnel. Environmental Protection Branch, Quartermaster Climatic Research Laboratory. Report No. 206, 1953.

Oshima, M., et al. Anthropometry of Japanese Pilots. Aerospace Medical Research Laboratories, AMRL-TR-65-74, 1965.

Park, Y. Development of public opinion surveys in Korea. International Social Science Journal, 1963, Vol. XV, No. 1.

Pascale, L. R., et al. Correlations between thickness of skinfolds and body density in 88 soldiers. In Body Measurements and Human Nutrition. Warne University Press, 1965, pp. 55-66.

Rutt, R. Korean works and days. Charles E. Tuttle, Rutland, Vt., 1964.

Sahley, L. W. Dimensions of the human figure. Cleveland Designers and Consultants, Inc., 1957.

Stoudt, H. W., et al. Weight, height, and selected body dimensions of adults. Public Health Service Publication No. 1000, Series 11, No. 8, 1965.

Tanner, J. M., and R. H. Whitehouse. Standards for sub-cutaneous fat in British children. British Medical Journal, February 1962, 1: pp. 446-450.

White, R. M. Anthropometry of Army Aviators. Quartermaster Research and Engineering Center, Natick, Mass., 1961.

White, R. M. Anthropometric survey of the armed forces of the Republic of Vietnam. Published for the Advanced Research Projects Agency by U.S. Army Natick Laboratories, 1964.

White, R. M. Anthropometric survey of the Royal Thai Armed Forces. Published for the Advanced Research Projects Agency by U.S. Army Natick Laboratories, 1964.

Wuelker, G. Questionnaires in Asia. International Social Science Journal, 1963, Vol. XV, No. 1.

APPENDIX

DETAILS OF EQUIPMENT EVALUATION

A. INTRODUCTION

The original purpose of the equipment evaluation study reported herein was to gain an understanding of the impact of personal, attitudinal, and other culturally related factors upon the acceptance of U. S. furnished equipment by Korean nationals. The Korean anthropometric study, which is reported in the text, focuses upon the systematic collection of anthropometric data from a fairly large sample of Korean military personnel. It was anticipated that concurrent analysis of the anthropometric data would identify those items of equipment which were unsatisfactory by virtue of being inappropriately sized for the Korean military population. Presumably, there would be a residue of equipment complaints not readily attributed to anthropometric causes, but which instead, could be linked to the cultural backgrounds of the soldiers.

Of secondary importance in the equipment evaluation portion of the study, but which might well have turned out to be the most significant aspect of the study in the years to come, were the planned methodological considerations of collecting attitudinal and other cultural measures in foreign cultures. It was thought that if a workable methodological tool could be developed in this study, or from a series of related research programs, the scientific community and the U.S. government would have available a most valuable new tool. With this new set of tools it would be possible to accurately and readily assess the non-tangible, but nonetheless influential, power of these kinds of variables, in a wide variety of foreign (and domestic) cultures. There has been a long standing need for this capability. In the history of science, possession of the ability to measure a

phenomenon has invariably been associated with the capacity to invoke means to control that phenomenon. Quite obviously, the U. S. Army strongly desires the ability to mold and change the variables involved in troop acceptance of materials and concepts brought in upon a soldier by an outside agency. Determination and improvement of acceptance is one of the Army's most ubiquitous problems in dealing either with its own personnel or those of its allies. While the conduct of the present study was originally designed to improve this urgently needed ability, circumstances associated with performing such kind of research enabled only a limited effort.

B. REVIEW OF LITERATURE

Very little unclassified attitudinal research has been conducted in Asia by the United States. While there are a number of books written about Korea and her culture, they are anecdotal in nature rather than rigorous, scientifically oriented works. Nevertheless, the available literature was culled for cultural tid-bits which would be helpful in designing a plan for attitudinal research in Korea.

Some of the information acquired in the literature search was used to guide the development of the research design. The remainder of this section treats the notions derived from the literature. Girard (1963) maintains that when selecting interviewers in Asian countries you should select them from the indigenous population being interviewed, and the social status of interviewer and interviewee should be the same insofar as possible. Every possible effort should be made to alleviate the very serious problems of translation and communication between the investigators and the interviewers during the training period ((Fink, 1963). When training interviewers it is suggested that very

little should be left to the interviewer's own judgment. Instructions should be given that can be followed point by point with a minimum of deviation. Fink observed that at those points where interviewers had to exercise judgments there were either omissions or errors. Questions requiring probing rarely achieved more than a fifty per cent response. Another good reason for training the interviewers to conduct highly structured interviews as opposed to highly unstructured interviews was the acute technical problems in communication (Atkins, 1961). A great deal of training is required to develop the necessary skills to effectively conduct highly unstructured interviews and so, in view of the communication problem between investigator and interviewer, this intensive training is generally out of the question.

Wuelker (1963) advocates the practice of a pilot or exploratory study prior to the launching of any full-scale survey. Techniques should be explored with the preliminary data in order to ascertain whether the items were put properly and whether they were answered frankly. In short, most if not all attitudinal questionnaires should be developed from a phenomenological theoretical base. This is especially true when there are cultural differences between investigators and respondents.

A study of North Korean and Chinese soldier's attitudes was conducted using a Likert-type scale (Kahn, 1955). While no attempt was made to check the validity of responses the data seemed to indicate that this type of American psychometric instrument could be used successfully with Asian people. However, there is a notion propounded by some which would call into question the utility of existing "American" objective psychometric techniques. This notion or construct is generally referred to as "courtesy bias." E. L. Jones (1963) discusses a series

of elements of which "courtesy bias" is composed among Asians. For example, the atmosphere between people must be kept pleasant and agreeable, with nothing said which wounds, affronts, or causes hurt to another. In fact, nothing should be said which another would not like to hear and, if possible, what is said should please and compliment. In no case may an individual disagree openly with a person of higher status.

On the basis of these elements Jones states that "it is particularly essential that the interviewer should not be identified with any client or sponsor. The South East Asian reticence to criticize a company or country with which he thought the interviewer was associated would immediately blur or eliminate entirely any helpful criticism of a product or unfavorable shading of a national image." Other ways of approaching the "courtesy bias" notion insofar as making respondents more comfortable in the expression of critical, negative, or perceived impolite answers are "projective" in nature. Projective pictures similar to those used in the Thematic Apperception Tests (TAT) might be used effectively. In this case the subjects are presented pictures and then asked to describe what they think might be taking place. Another approach is to preface each item with "Many people around here tell me that ..." or "I hear people often say that ... ." In each of the instances mentioned above the pressure is somewhat diminished for the respondent because he need not feel that his particular views are being scrutinized by themselves. In effect, however, the respondents are expressing their own views, or so it is assumed by the investigator.

While there are some who accept the notion of "courtesy bias" with little or no reservation there are others who are not so inclined. One such behavioral scientist who is a Korean national (Park, 1963) has made the

following observation in this regard: "It has long been assumed that most of the people are reluctant to give frank answers to survey questions as a result of the long repression of public opinion under the dictatorial Rhee regime. But the number of surveys carried out since the two recent revolutions seems to indicate that such attitudes are rapidly diminishing." There are others who maintain that the great numbers of G.I's in Korea for the past fifteen years and their willingness to express their feelings about anything associated with Army life has no doubt contributed a great deal to the disappearance of the "courtesy bias" phenomenon.

There seems to be some question then as to the degree of existence or non-existence of "courtesy bias." Certainly, from a methodological point of view, this becomes a very serious consideration. If the Koreans are, in fact, so reluctant to say anything which they believe might hurt the feelings of another that they do not readily express their "true" feelings on a standard questionnaire, then special precautions need to be considered in the design of the data collection procedures. On the other hand, if Korean soldiers willingly and frankly express themselves, then little or no time need be wasted developing elaborate precautionary measures such as highly unstructured, difficult to score and interpret, projective techniques.

Generally speaking there are those who would advocate special considerations in the design of any psychometric techniques to be used on an Asian population due to the vast differences in national customs, heritage, and basic philosophy (Atkins, 1961). In Korea the pace is considerably slower than it is in the United States; there is a great deal more pressure to have children; in the country sorcerers and sorceresses are still used; and Korean rural life is firmly geared to cycles of the sun, moon, and stars, with little or no

attention given to mechanical time pieces (Rutt, 1964). It would appear, however, that urban dwellers have become very much westernized and there have been drastic changes in their mores, ethics, and culture in the last couple of decades. All of this seems to suggest that careful consideration need be given not only to instrument design, but to sampling procedures as well so that the apparent urban-rural variables may be adequately controlled.

In spite of all the problems which seem to be associated with such a study as this, there are some which seem to have been successful. Kahn (1955) conducted a study of North Korean and Chinese soldiers' attitudes toward the Korean War. Prisoners were administered questionnaires which employed Likert's Agree - Disagree scales. The subjects were instructed not to write their names on the questionnaires and were assured that their responses would remain anonymous. They were strongly encouraged to be completely honest about every item. Although no attempt was made to check the validity of responses other than an intra-scale item reliability check, trends and consistencies appeared in the data which were suggestive of valid data. North Korean officers were more optimistic about the outcome of the war than were the enlisted men. Training and time in service seemed highly positively related to opinions. Former students tended to be more unfavorable to the enemy.

In some respects this study is rather astounding. Not only was the study subject to the pitfalls we have discussed thus far, but in addition there was the possibility of a generally hostile attitude, or the implied threat of punishment to unpenitent prisoners, etc. It seems that there were many reasons to assume guarded responses which over-all would yield but a small amount of reliable information, and yet, this did not seem to be the case at all.

Needless to say, as is often the case in a review of psychological literature, the data and especially the interpretations thereof are somewhat confusing. Part of this confusion may be attributable to the fact that investigators are all too often so involved in discovering the "hidden treasure" that they lose the map which got them there. Without a detailed reproduction of the map other treasure seekers may never travel the same path, nor will they be able to compare routes to determine which is best. In short, too little attention is given the methodology of attitudinal research. All too many authors assume that what has been developed to date is tried and true and is applicable in all situations even though the rules of the game may be changed. The present authors have found that if reasonably valid attitudinal data is sought, the data collection instrument and procedures must be subjected to a very thoroughgoing, systematic, iterative, analyses. A preliminary, rough cut instrument must be tried on a pilot group with the subsequent data used to refine the major data collection instrument (Hart, 1964). The important point here is that in any novel or semi-novel survey situation great care should be taken with respect to methodology. Those assumptions recognizable to the author should be made explicit and specific, testable hypotheses formulated in regard to the data collection techniques as well as for the attitudinal data sought. Such a procedure is mandatory if one is to assess the value of the attitudinal data, quantitatively identify the validity of the instruments themselves, and provide the only firm basis for further methodological research.

C. HYPOTHESES

In keeping with the idea developed in the preceding section hypotheses have been generated for both the methodological and the attitudinal aspects of

the study. For the most part the methodological hypotheses were formulated prior to the collection of any data from either the pilot group or the main sample population. This was possible because the authors were experienced researchers in the development of attitude assessment techniques for use in military, overseas, field-based research settings and were able to anticipate a good many of the problems which would eventuate; also, the literature posed some problems with respect to conducting attitude surveys in Asian cultures which lent themselves to hypothesis generation and testing.

On the other hand, the attitudinal hypotheses were not formally stated until after the pilot study. The reason for this was simply there was not previous research in this particular content area which could be used as a comparative base. Some feedback was required from the pilot study before meaningful, critical hypotheses could be formulated for testing.

1. Methodological

a. There will be no difference between responses to highly structured techniques and responses to unstructured techniques. The assumption underlying this null hypothesis is that the unstructured projective techniques will be less affected by the phenomenon of "courtesy bias" (if it exists) than the more straightforward "objective" techniques. If "courtesy bias" is operative one would expect projective responses to be more negative than objective responses.

b. There will be no differences between responses to specific items and responses to general, more global items. If "courtesy bias" exists one suspects it is possible that the more specific type items would elicit more negative responses.

c. Responses will not be a function of the subject's perception of the purpose of the survey. More specifically, whether the troops are told they are to evaluate their equipment, or they are told to evaluate their equipment which has been given to them by the United States, is of no consequence. Again, if the notion of "courtesy bias" is valid one might expect respondents who are asked to evaluate equipment supplied to them by the United States to be less critical than those troops who are merely asked to evaluate their own equipment.

d. There will be no differences between responses to various psychometric scaling techniques (such as Likert-type scales, semantic differential scales, and non-verbal, numerical scale representations.) It is quite possible that scales with extreme adjectives, and scales with agree-disagree stimuli, will be more affected by "courtesy bias" than will scales without the heavy verbal loading.

Unfortunately, the first trip to Korea for the pilot study coincided with administrative restriction imposed by the U.S. authorities on acquisition of attitudinal data from non-USA nationals. This restriction was not aimed at the present study but instead was a result of a situation originating elsewhere in the field of social science research. Nonetheless, the attitudinal research aspects of the present study were effectively throttled by the new doctrine. Circumstances thus would not permit exploration of the methodological problems defined above. Accordingly, the research emphasis was hastily reoriented and information was acquired which permitted the exploration of equipment evaluation and performance.

2. Equipment Evaluation

a. There will be no difference in the acceptability of the carbine and M-1 rifle. The null hypothesis will be tested with the expectation that the carbine will be more acceptable than the M-1 rifle.

b. There will be no difference in the general acceptability of the fit of U.S. supplied equipment between respondents whose stature is equal to or greater than the 50th percentile and those whose stature is below the 50th percentile. Knowing in advance that Koreans tend toward a shorter physical stature than USA nationals, one suspects their lower 50 percentile people will have substantially more troubles than their upper 50 will.

c. There will be no difference in the general acceptability of the fit of U.S. supplied equipment between respondents whose weight is equal to or greater than the 50th percentile and those whose weight is below the 50th percentile. As in 2b above, weight may also be significant.

d. There will be no difference in the acceptability of the 2-1/2 ton truck and and the 1/4-ton truck. The null hypothesis will be tested with the expectation that the 1/4-ton truck will be more acceptable than the 2-1/2-ton truck.

D. RESEARCH DESIGN

1. General Description

The underlying theoretical position which determined the research design of this project can best be characterized as phenomenological. The danger of constructing data collection instruments which were designed in one cultural milieu, to be used in another entirely different culture, especially when so little is known about the latter, is patent. Some feedback was necessary from

the population for which the survey was to be designed in order to avoid major pitfalls which would probably negate the entire study. In the United States it has been found next to impossible to construct culture-free psychological tests which would permit the collection of bias-free data. Social scientists have developed some ways to control for culture biases such as standardization techniques and exotic sampling procedures, and they still are hard pressed to be able to adequately interpret the data we collect. Consequently, like Wuelker (1963) the present investigators saw a need for a pilot study prior to the major data collection effort which itself was considered to be highly exploratory.

In order to develop adequate assessment techniques for the major data collection effort it was first necessary to determine the topics and dimensions of topics which were salient to Korean troops about which equipment evaluation items could be written. Certainly it would be presumptuous of the investigators to assume that they know enough about the values, beliefs, and other psychological characteristics of an Asian culture to be able to construct a valid, sophisticated assessment battery totally a priori. Unfortunately, and all too often, rating scales are constructed on the basis of what the investigator thinks about the target population rather than what he knows about them on the basis of empirical evidence.

In the present study the investigators immersed themselves in the Asian-related literature and then, after determining the kinds of information they would need, some rough-cut data collection instruments were developed. These instruments were to be used to collect data which would permit the construction of a refined data collection system. The reasons which make such a pilot study necessary are several:

a. One can explore alternative data collection strategies; interview, questionnaire, critical incident reports, essays, controlled observation of work, etc.

b. One can experiment with various topical questions to test their understandability, breadth of applicability, etc. (Language problems loom here, as could the "courtesy bias" problem.)

c. Variations in format, timing, placement and other characteristics of the data collection instruments can be systematically tried out.

d. Procedures for setting up and carrying out interviews can be explored.

e. Data management activities can be established and exercised. When acquiring a fairly large mass of data it is best to make sure it can be managed in a sensible fashion before the time and energy of hundreds of people are squandered in giving data which cannot be used. Pilot study data may be used in such a way that objective materials, which will probably be computer processed, can be used to write and debug computer programs using real data and form real data formats. Content analysis procedures for use with interviews or projective materials can be created with topical categories which fit the kind of data one obtains from his particular target population.

The data collected during the pilot study was carefully reduced, analyzed, and interpreted after which the "final" instrument was constructed for the major data collection effort.

2. Pilot Study

The pilot study was conducted at various sites in Korea during the first two weeks of June, 1965.

a. Description of Instruments

Data was collected by way of a questionnaire and structured interviews. In accordance with prior experience in this field, both techniques were designed to elicit the kind of information which would permit writing high quality objective and projective items to be used subsequently in the major data collection effort.

1) Questionnaire: The "Listing Technique" which was developed for use in an attitudinal study for Natick Laboratories (Hart, 1964) was the format used in the questionnaire. The Listing Technique consists of items which request the respondents to list three characteristics, attributes, items, conditions, etc., which they like, dislike, want, etc., concerning some topic (item of equipment or condition). For example:

1. Three weapons which are the most difficult for Korean soldiers to use effectively are:

A	B	C

For each of the weapons you have listed above, give three reasons <u>why</u> it is difficult to use the weapons effectively:

1.	1.	1.
2.	2.	2.
3.	3.	3.

This approach to attitude assessment combines some of the advantages of both the structured and unstructured techniques. The questionnaire provides structure by prescribing the generic class to which the responses must be directed, at the same time the respondent is permitted the freedom to indicate

the most salient components of the class, if any. Also, rather than forcing respondents to indicate their position on psychological scales related to topic dimensions specified by the investigator, they are allowed to indicate the salient dimensions of their own choosing. These dimensions are expressed in response to the "give three reasons why" portion of the questionnaire items.

In short, the "Listing" technique permits the acquisition of saliency information from the target population. The primary use to which this information is put is the development of attitudinal items custom tailored to the population. In the case of the example cited above, the investigator is interested in the generic class of equipment called "weapons" and the respondents will identify, 1) those weapons which they feel are difficult for Koreans to operate effectively; and 2) those dimensions of specific weapons which have the greatest influence on their evaluations of weapons.

2) The Structured Interview: Basically the structured interview approach was used to explore most of the same content areas covered by the questionnaire, only in more depth. It was also used to "validate" the data collected via the questionnaire by comparing the answers obtained in each collection. A typical interviewer question is as follows:

> 1. If any, what items of equipment supplied to ROKA by the U.S. Army do you feel have serious need for improvement? Why?

Korean civilians were selected for interviewers and they were trained intensively for three days. They were instructed in interviewing techniques in general and in the purpose and expectations of this study in particular. After two days of instruction the interviewers conducted their interviews using members of the research team as interviewees. The training was culminated with

a series of role playing situations in which the interviewers interviewed one another.

Each interviewer memorized an introduction which he presented at the commencement of each new interview. The introduction was used primarily to explain the purpose of the interview and to assure the interviewees that their remarks would be held in strictest confidence.

The interviewers read or recited from memory each specific item in the interview, about which data was sought. They were instructed to record the responses verbatim without replies on their part of any kind. At the conclusion of the respondent's volunteered remarks the interviewers were to probe for more complete answers and to dig out any notions they felt were being inhibited. While the interviewers had been instructed to be as flexible as possible and to dig as best they could, little more was expected beyond responses to the structured portion of the interviews on the basis of Fink's (1963) experience with interviewing techniques used in Asia.

b. Results

The "listing" technique and the structured interviews provided data so similar that it is necessary to present only the data of the "listing" technique. Table A-1 contains the topics and their relevant dimensions which were contributed by the ROK and KATUSA subjects. The weapon which was considered by far the least acceptable was the M-1 rifle. The carbine was most acceptable, the 1/4-ton truck most acceptable, etc.

The most salient topics and dimensions with respect to "fit" were selected to be used in the major data collection effort.

Contrary to Fink's (1963) findings, the interviewers used in the present study were readily capable of exploring beyond the structured interview itself and demonstrated a high degree of flexibility and personal initiative, as good, for that matter, as one would hope for from sophisticated interviewers anywhere in commercial market research practice.

3. Equipment Evaluation Survey

One format was used for the collection of equipment evaluation information. Three optical scan cards were included at the end of the anthropometric data collection booklet which contained items relating to equipment evaluation.

The twenty items included in the booklet are listed on page A-22. Five topics are included with approximately three dimensional items each. One item for each topic has been included to assess the topical experience level of each respondent.

TABLE A-1. TOPICS AND DIMENSIONS IDENTIFIED AS BEING SALIENT TO ROK AND KATUSA TROOPS

Weapons which are regarded by Korean sample as most difficult to operate effectively:

ROKA			KATUSA		
Weapon	Saliency Score	N	Weapon	Saliency Score	N
M-1 rifle	210	70	M-1 rifle	187	65
BAR	58	25	Light machine gun	26	13
Light machine gun	35	17	M-14	21	11
57 mm. rec. rifle	20	9			

Weapons which are regarded by Korean sample as easiest to operate effectively:

ROKA			KATUSA		
Weapon	Saliency Score	N	Weapon	Saliency Score	N
M-2 carbine	215	73	M-2 carbine	180	64
M-1 rifle	22	10	M-14 rifle	73	32
			3.5 rocket launcher	17	8

Army vehicles regarded by Korean sample as most difficult to operate effectively:

ROKA	KATUSA		
	Vehicle	Saliency Score	N
No experience	2-1/2 ton truck	43	15

Army vehicles regarded by Korean sample as easiest to operate effectively:

ROKA	KATUSA		
	Vehicle	Saliency Score	N
No experience	1/4 ton truck	98	38
	3/4 ton truck	54	25
	2-1/2 ton truck	20	8

TABLE A-1. TOPICS AND DIMENSIONS IDENTIFIED AS BEING SALIENT TO ROK AND KATUSA TROOPS (Continued)

Army wearing apparel disliked most by the Korean sample:

ROKA			KATUSA		
Apparel	Saliency Score	N	Apparel	Saliency Score	N
Steel helmet	111	45	Steel helmet	60	25
Fatigues	86	34	Fatigues	43	16
Pack	22	9	HBT	38	15
Combat boots	19	11	Pack	25	11

Army wearing apparel liked most by the Korean sample:

ROKA			KATUSA		
Apparel	Saliency Score	N	Apparel	Saliency Score	N
Fatigues	47	17	HBT	45	18
Shovel	27	13	Fatigues	30	10
			OG 108	26	12

Foods disliked most by the Korean sample:

ROKA			KATUSA		
Food	Saliency Score	N	Food	Saliency Score	N
Bean sprout soup	33	14	Horsemeat	39	14
Boiled barley & rice	28	15	Bean sprout soup	35	13
Bean paste soup	28	12	Fish	15	8
Cabbage soup	28	11			
Vegetable soup	25	10			

Foods liked most by the Korean sample:

ROKA			KATUSA		
Food	Saliency Score	N	Food	Saliency Score	N
Meat	104	44	Chicken	62	25
Meat Soup	39	16	Kimchi	49	22
Boiled rice	32	11	Rice	44	17
Kimchi	26	12	Meat	33	15
Fish	25	10	Milk	18	9

TABLE A-1. TOPICS AND DIMENSIONS IDENTIFIED AS BEING SALIENT TO ROK AND KATUSA TROOPS (Continued)

Characteristics of U.S. equipment which are disliked most:

M-1 RIFLE

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Weight	141	53	Weight	160	57
Length	64	27	Length	41	21
Unfit	50	20			
Size	34	13			

LIGHT MACHINE GUN

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Weight	41	21	Weight	33	11

2-1/2 TON TRUCK

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
No experience			Size	18	7

STEEL HELMET

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Weight	112	39	Weight	59	22
Size	42	20	Size	39	16

FATIGUES

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Size	93	34	Size	42	15
Durability	14	6	Appearance	11	5

TABLE A-1. TOPICS AND DIMENSIONS IDENTIFIED AS BEING SALIENT TO ROK AND KATUSA TROOPS (Continued)

Characteristics of U. S. equipment which are liked most:

M-2 CARBINE

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Weight	114	42	Weight	154	54
Fit	84	31	Fit	50	22
Accuracy	49	26	Accuracy	25	16
Length	15	7	Length	18	9

M-14

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
No experience			Weight	30	10
			Handling & loading	22	11
			Accuracy	20	10

JEEP

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
No experience			Driving ease	42	17
			Simplicity	25	11
			Vision	11	5

FATIGUES

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Durability	24	8	Durability	15	5
			Appearance	7	4

TABLE A-1. TOPICS AND DIMENSIONS IDENTIFIED AS BEING SALIENT TO ROK AND KATUSA TROOPS (Continued)

Characteristics of U.S. equipment which are disliked most in general:

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Interface	68	24	Interface	100	37
Weight	42	18	Weight	33	15
Size	33	12	Size	29	10

Characteristics of U.S. equipment which are liked most in general:

ROKA			KATUSA		
Characteristics	Saliency Score	N	Characteristics	Saliency Score	N
Durability	93	34	Durability	109	41
Quality	32	12	Practicality	76	33
Practicality	24	9	Quality	28	13

Note: Saliency scores were calculated by assigning a value of 3, 2, or 1 to the topic or dimension according to its listed position; and then summing the scores for a topic across individuals.

EQUIPMENT EVALUATION ITEMS

M-1 RIFLE

1. When firing the M-1 rifle, grasping the stock at the proper place is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

2. When firing the M-1 rifle, reaching the trigger properly is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

3. When sighting the M-1 rifle, properly positioning the head with respect to the rear sight is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

M-2 CARBINE

4. When firing the M-2 carbine, grasping the stock at the proper place is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

5. When firing the M-2 carbine, reaching the trigger properly is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

6. When sighting the M-2 carbine, properly positioning the head with respect to the rear sight is:

   Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

2-1/2 TON TRUCK

7. The accelerator on the 2-1/2 ton truck is:

   Easily reached ☐ ☐ ☐ ☐ ☐ ☐ ☐ Difficult to reach

8. The seat-windshield configuration of a 2-1/2 ton truck provides the driver with:

   Excellent vision ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very poor vision

2-1/2 TON TRUCK (Continued)

9. Steering the 2-1/2 ton truck is:

Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

1/4 TON TRUCK

10. The accelerator on the 1/4 ton truck is:

Easily reached ☐ ☐ ☐ ☐ ☐ ☐ ☐ Difficult to reach

11. The seat-windshield configuration of the 1/4 ton truck provides the driver with:

Excellent vision ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very poor vision

12. Steering the 1/4 ton truck is:

Very easy ☐ ☐ ☐ ☐ ☐ ☐ ☐ Extremely difficult

STEEL HELMET

13. Wearing the steel helmet interferes with vision:

Little, if at all ☐ ☐ ☐ ☐ ☐ ☐ ☐ A great deal

14. My steel helmet (and liner) fits:

Perfectly ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very poorly

GENERAL

15. Insofar as "fit" is concerned, the equipment supplied by the U. S. Army is:

Excellent ☐ ☐ ☐ ☐ ☐ ☐ ☐ Very poor

16. I have fired the M-1 rifle:

Many times ☐ A few times ☐ Never ☐

GENERAL (Continued)

17. I have fired the M-2 carbine:

Many times ☐ A few times ☐ Never ☐

18. I have driven the 2-1/2 ton truck:

Many times ☐ A few times ☐ Never ☐

19. I have driven the 1/4 ton truck:

Many times ☐ A few times ☐ Never ☐

20. I have worn the steel helmet:

Many times ☐ A few times ☐ Never ☐

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13. ABSTRACT

Anthropometric and equipment evaluation surveys of the military personnel of the Republic of Korea were conducted between May and November of 1965. Body measurements and equipment evaluation data were obtained on a series of 3,747 men (3,249 Army, 190 Air Force, 141 Navy, and 167 Marine). Fifty-nine body measurement and twenty equipment evaluation measures were made on each individual. Procedures and supporting equipment were developed during the course of the project which permitted the collection of more data with greater accuracy in less time and with greater statistical interpretability than in any other anthropometric survey of record.

Of the 59 body measurements taken from Korean soldiers, 39 were directly comparable with data which had been previously collected from U. S. troops. The differences between means of the two samples were statistically significant for 30 of the measures. The means of data from U. S. troops exceeded those of Korean soldiers on 33 of the measures, indicating larger physical size in almost all dimensions.

Korean troops expressed themselves on the question: "Insofar as 'fit' is concerned, the (equipment) supplied by the U. S. Army is ....." on a seven-point continuum ranging from "excellent" to "very poor." Respondents filled out a questionnaire containing general statements described above as well as more specific items relating to grasping, reaching, and positioning the equipment insofar as comfort and effectiveness were concerned. Subjects rated the smaller, lighter equipment favorably with respect to ease of handling, and reported considerable difficulty using larger weapons and equipment.

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